MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 8 DECEMBER, 1935 Number 7

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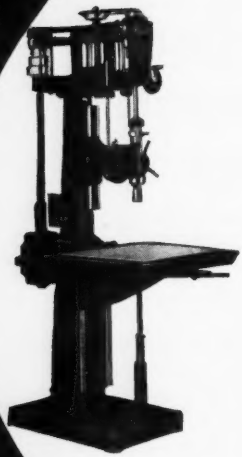

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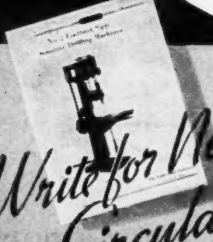

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MODERN Machine Shop

INCINNATI, OHIO VOL. 8, NO. 7

DECEMBER, 1935

Quantity Production of Automotive Pistons

Here are some excellent examples of the type of fixtures and tools used in modern high production manufacturing.

BY FRED B. JACOBS

THE manufacture of engine pistons is an important branch of the automotive parts industry, and in a normal year a production of some 5,000,000 pistons is not uncommon. This figure includes pistons both for new cars and for replacements.

Piston production involves two salient features. First, close manufacturing tolerances are demanded to meet present-day requirements of accuracy and performance. Second, due to the fact that the parts manufacturing business is a highly competitive one, low manufacturing costs are imperative and therefore the production time for each manufacturing operation must be reduced to the minimum. Success in the achievement depends to a large extent upon careful selection of the production machines and upon the design of the tools.

This article describes and illustrates some of the more interesting operations in the manufacture of pistons at the plant of the Dall Manufacturing Company, Inc., Cleveland, Ohio. The Dall Company has for many

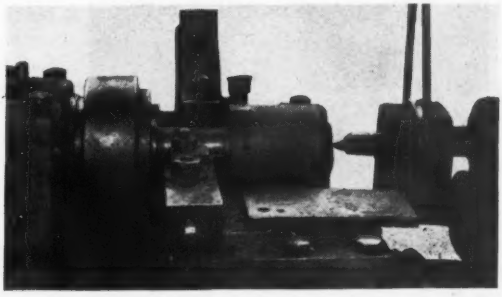

Fig. 1—Piston in position for boring, facing, and centering.

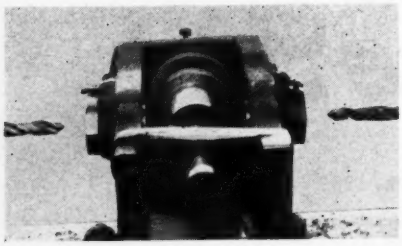

Fig. 2—Rough drilling the wristpin holes.

years supplied manufacturers and repair men with pistons, the annual output of this plant for replacements alone amounting to approximately 400,000 pistons per year. The operations described here are typical for the average piston.

The machining of a piston usually involves 14 operations, as follows: (1) Chuck from the inside, face bottom of skirt, bore skirt, center head end; (2) rough turn; (3) rough drill piston pin hole; (4) face head; (5) ream open end; (6) recenter hole in head; (7) rough and finish ring grooves; (8) finish turn; (9) drill smoke holes; (10) bore piston pin holes; (11) bush piston pin holes if required; (12) drill oil holes through bottom; (13) relief grind if required; (14) grind head. The foregoing comprises the schedule

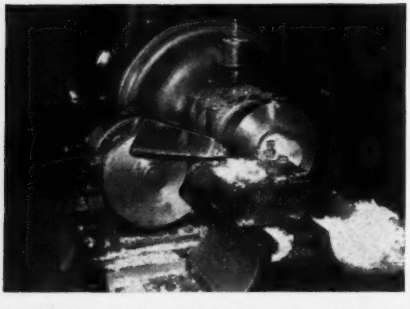

Fig. 3—Facing the head of the piston. The tool is fed by a cam that is driven from the feed-screw.

of operations required on a semi-finished piston; if the piston is to be finished to size before shipment, a fifteenth operation of finish grinding must be added.

In Fig. 1 is shown a cast iron piston chucked and ready for the initial operation. The piston is gripped firmly from the inside by means of an air-operated expanding chuck. The three operations of boring the skirt, facing and centering the closed end are performed simultaneously, a tool in the rear toolholder feeding across the open end while a boring tool held

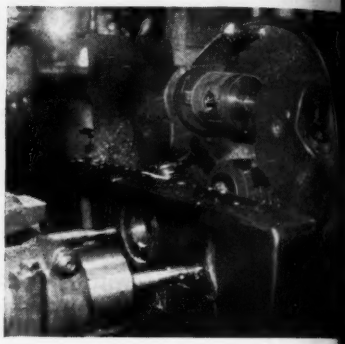

Fig. 4—Here the wristpin hole is rough bored with a tungsten carbide boring tool and finished to size with a diamond-tipped tool.

the front toolholder feeds longitudinally and thus bores the skirt to size. At the same time the centering tool held in a spindle that is driven by a round belt from an overhead pulley, is fed in to drill a center hole in the closed end of the piston. Thus the bore and face of the open end are square with each other, and the center hole is in exact line with the bore of the open end.

The operation of rough drilling the wrist pin holes is shown in Fig. 2. The piston is inserted into this boring like fixture and located by seating on a round base that fits the bore in

open end, pressure being applied to the head end by means of a clamp that can be seen in the foreground. Bushings in either side of the fixture guide the drills, which are automatically fed from both sides at the same time.

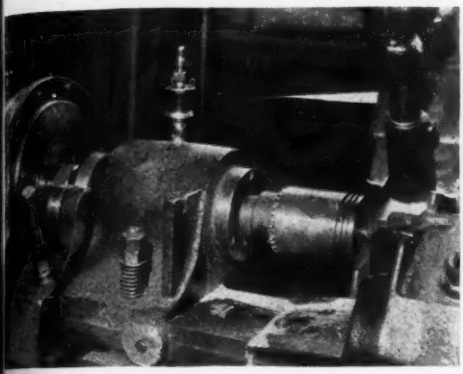

Fig. 5—Grinding the piston to size. The eccentric on the skirt is produced by rocking the fixture as the piston revolves, the rocking movement being accomplished by a cam and cam roller.

Figure 3 shows an aluminum alloy piston in process of having the head faced. The piston is located on a base projecting from the faceplate, and is held by a pin that is passed through the wrist pin hole and through a hole in a draw-rod that is pulled back by means of an air-operated cylinder. This operation is semi-automatic, the facing tool being held in a block that is fed forward by a cam for which power is supplied through a speed reducer connected with the lead screw.

In any high-grade piston the wrist pin hole must be perfectly round, straight, and smooth within exceedingly close limits. At the Dall plant, these holes are diamond-bored in the machine shown in Fig. 4. This is an Ex-Cello-O three-station diamond boring machine equipped with two boring bars, each running at a speed of 3,600 r.p.m. The spindle in the foreground is equipped with a tungsten carbide tool for rough boring, while the spindle in the lower background is fitted with a diamond point tool for finishing the surface of the hole.

Near the top of the illustration Fig. 4 can be seen a piston in loading position, the loading being done while the two spindles are operating on pistons in the other two stations. The piston is held between centers in such manner that it will not be sprung or cramped out of shape.

The operation of finish grinding the cylindrical surface of a piston is shown in process in Fig. 5. The machine is a Landis plain grinder of 10x24-in. capacity, equipped with a National silicon carbide 18-in. diameter wheel with a 2-in. face, 163 grit, grade H. The wheel runs at a speed of 1350 r.p.m. while the work revolves at a speed of 200 r.p.m. The piston is held between centers and is driven by a cross-pin and draw-rod similar to that used in the lathe. Fig. 3. The wheel described here is used for the grinding of both cast iron and aluminum alloy pistons.

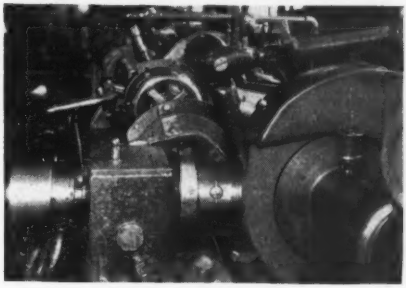

Fig. 6—Grinding the head of the piston so that carbon formation will be reduced to the minimum.

The interesting feature of the finish grinding operation is the manner in which an eccentric contour is imparted to the skirt of the piston. The centers between which the piston is held are located on an independent fixture that can be rocked back and forth, to or from the grinding wheel. At the left end of the fixture is a section

Fig. 7—Slotting the skirt.

carrying a cam roller which runs in contact with a cam on the end of the headstock spindle. As the cam revolves, it swings the fixture, carrying the piston, back and forth so that the required eccentric shape is obtained. A heavy spring holds the fixture in position and keeps the roller in contact with the cam.

The head of the piston is ground as shown in Fig. 6. In this operation the piston is held in a special fixture the axis of which is at right angles to the axis of the grinding wheel, as shown, so that the head of the pist can be fed against the periphery the wheel. Here again the piston held in postion by an air-operat draw-bar, the piston being located a boss on the faceplate which into the open end of the piston.

The machine is a Landis pl 10x24-in. grinder, fitted with a wh of the same grit and grade as t wheel used for the skirt grinding eration shown in Fig. 5. With t piston rotating at a speed of 2 r.p.m., it is fed back and forth acr the face of the wheel and just enou metal is removed to true up the su face and conform to the required d mension between the head and t wristpin hole. The head of the pist is ground both to insure an equ amount of compression in all cyli ders and to prevent the formation carbon as far as possible.

Many types of aluminum alloy p tons are provided with slotted skir the slotting operation being perform after the finish grinding so that th fullest support possible will be ob tained in the grinding operation. T slotting operation is performed in th special slotting machine shown in Fi 7. This machine, which was develope by the Dall Company for its own us and for the trade, is powered by a 1 h.p. motor which drives a reciprocat ing saw that can be seen projectin through the skirt of the piston at it lowest point. The piston rests in V-shaped table, where it is guided b hand. Power is controlled by mean of a foot treadle.

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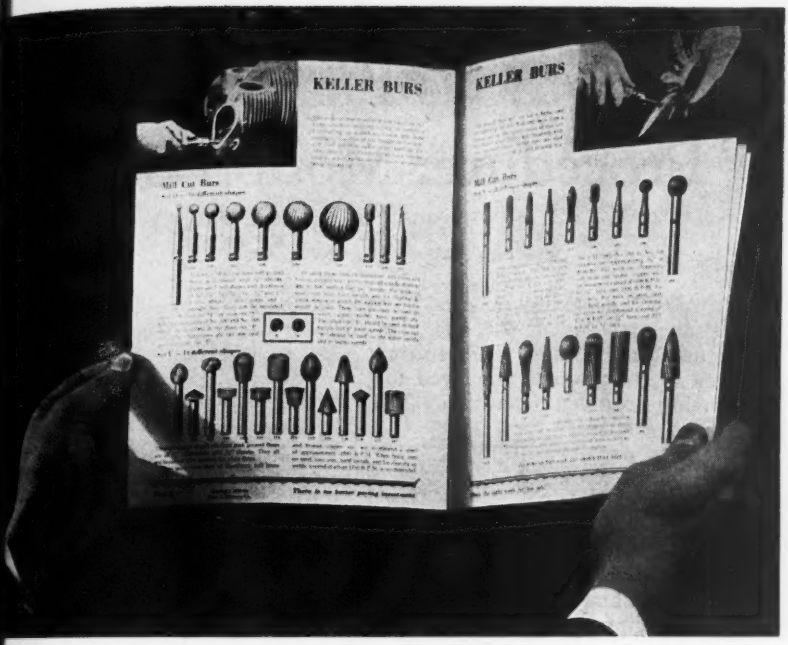

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Methods Engineering Procedure: Motion Study

By H. B. Maynard,
President, Methods Engineering Council, Inc.

The third article, in which the author outlines the advantages of motion study and explains how a study is made.

BROADLY speaking, a motion study may be almost any kind of a study during which consideration is given to the motions employed for performing a given operation. The term "motion study," however, is usually employed in a more limited sense and is considered to apply only to the study of the basic divisions of accomplishment used for doing an operation in order to determine the best method for doing it. It consists, briefly, of dividing the operation into basic elements, studying these elements separately and in relation to one another, qualitatively and quantitatively, and as a result determining by synthesis the most efficient method.

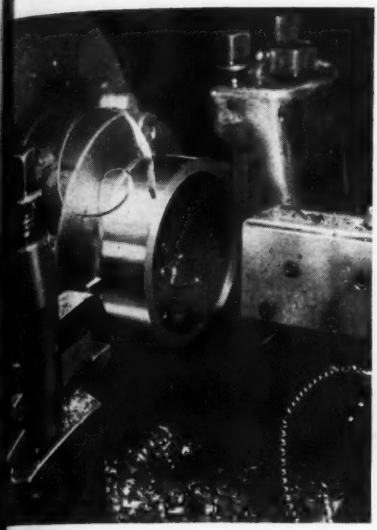
Field of Motion Study

There has been and still is considerable confusion with regard to the proper field of motion study. Some men feel that motion study is a laboratory process applicable only to highly repetitive hand operations. Others feel that it embraces every step of a study up to stop watch observations. And finally, still others feel that motion study is the answer to all management problems.

These points of view are all understandable in the light of the history of the development of methods engineering. At one time there were two sharply divided schools, which stressed time study, and other which stressed motion study. As time passed, however, it became clear that the difference between these two were largely a matter of the amount of emphasis which was placed on time study or motion study, and that this emphasis was governed by conditions under which the two groups were working.

The so-called time study men in general handled small quantity work which did not permit an exhaustive study of methods. The motion study men, on the other hand, dealt with large quantity work. The shortening of a single motion path a distance of four inches might mean a saving of hundreds of dollars per year, so quite naturally they felt that the method was the chief concern and the time of secondary importance. As a matter of fact, neither of these groups entirely neglected the study of either time or motions.

This difference in emphasis has largely disappeared during recent years. The modern methods engi-



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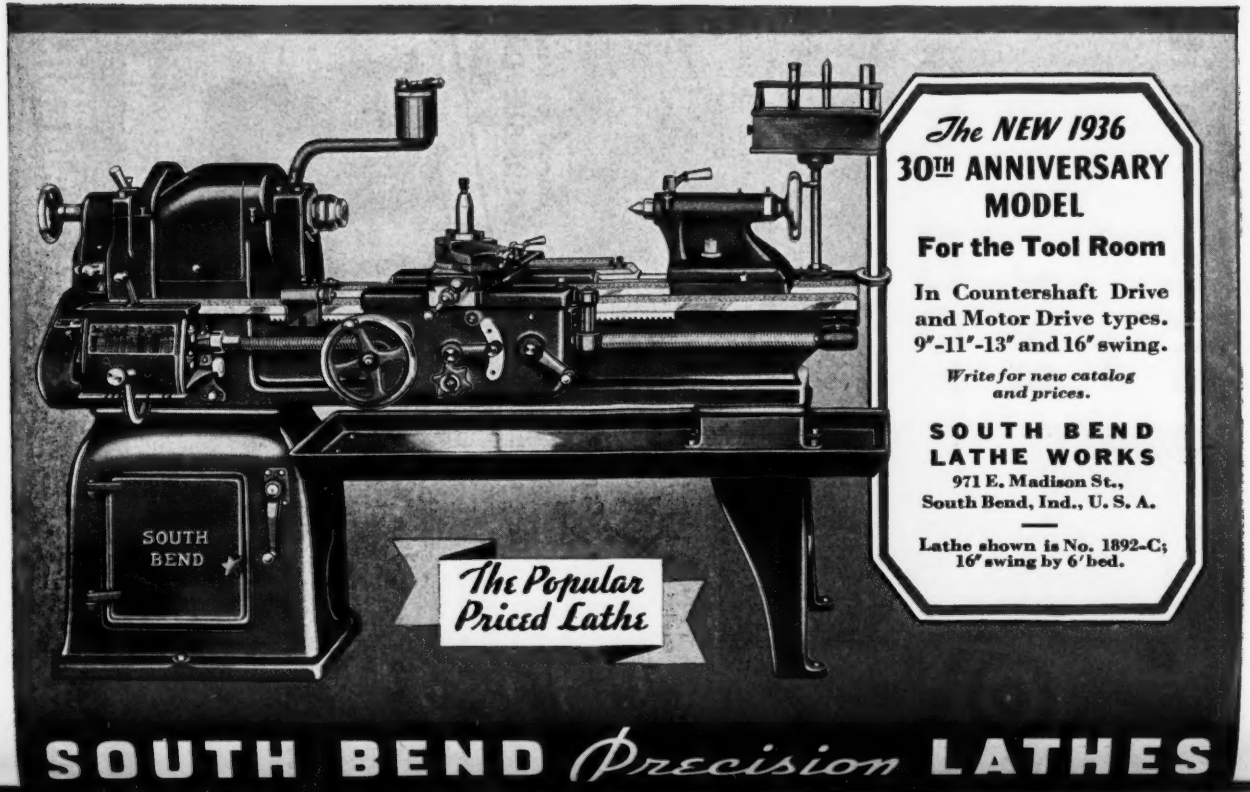
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s thoroughly familiar with all phases f the technique of methods study. He is equipped with a complete nowledge of job analysis, motion tudy, motion characteristics, process harts, stop watch time study, and elated branches of the science. The xtent to which he uses one or the ther of these tools depends upon the onditions which surround the work he is studying. His aim at all times s only to do work that is economi- lly justified.

It obviously will be impractical to ake a motion picture of a job for urposes of detailed film analysis if he job will be completed before the lm can be developed. If a job is to st for several months, detailed an- lysis, motion study, and time study re justified. If it will last several eeks, a more rapid motion study by nalysis and observation and time tudy are indicated. For a job of a w days duration, analysis, careful me study, and such improvement in otion sequence as can be made im- ediately while the time study is be- g taken are as much as it is profit- ble to undertake. When jobs last ss than a day, individual studies are ldom practical, and time formulas ould be constructed.

Regardless of the type of work e studies, however, the methods gineer considers his knowledge f the principles of motion study mong the most valuable of the in- rmation which he possesses, and he pplies it continually whether he is aking formal motion studies or not. or example, he knows that a motion n be made more quickly with the bow acting as a pivot that it can hen the shoulder acts as a pivot. his information guides him in im- roving workplace layouts, and can e used and applied quickly without aking pictures or following any elab- rate or lengthy procedure. Stated differently a knowledge of the principles of motion study enables the methods engineer to deliver a much better grade of analysis and stop watch time study work.

Motion Study Technique

Motion study deals with basic divisions of accomplishment or basic operations. There are eighteen of these which may be classified and listed with abbreviated symbols as follows:

Purely Physical Basic Divisions	
Transport Empty	TE
Transport Loaded	TL
Change Direction	CD
Grasp	G
Hold	H
Release Load	R
Pre-position	PP
Semi-Mental Basic Divisions	
Position	P
Search	S
Select	SE
Mental Basic Divisions	
Plan	PL
Inspect	I
Objective Basic Divisions	
Use	U
Assemble	A
Delay Basic Divisions	
Avoidable Delay	AD
Unavoidable Delay	UD
Rest to Overcome Fatigue	F
Balancing Delay	BD

All of these basic divisions have certain known characteristics, and the appearance of any one of them in the operation cycle is an indication to the methods engineer of the action which must be taken. In general, the basic divisions "search", "select", and "hold" should be eliminated. "Position" should be eliminated where possible by stops and guides. "Pre-position" should seldom appear in the motion sequence as a

separate operation, and "plan" should appear but rarely upon repetitive work if at all. Most "unavoidable delays", or delays which are the responsibility of management, should be eliminated. All other divisions should be reduced in number and time by a systematic rearrangement of work place, tools, and methods.

A knowledge of the basic divisions of accomplishment and the ability to recognize them is of great assistance in making improvements in operating methods. For example, assume that a small part has a simple machining operation performed on it, such as the drilling of a ⅛-in. hole. One of the elements of this operation will be "Pick up small part". Where a methods study has not been made, the part will in all probability be in an ordinary container placed more or less conveniently wherever there is room near the machine. Perhaps a number of parts will be placed at one time on the machine table where they will lie scattered about more or less haphazardly.

In any event, the basic divisions of accomplishment used in picking up the part will consist of "transport empty", "search", "select", "grasp", and "transport loaded". The methods engineer knows that in accordance with one of the laws of motion economy, the number of basic operations should be reduced to a minimum to secure the greatest operating efficiency. Hence "search" and "select" at once become suspect. Analysis shows that they are made necessary because the parts are not always obtained at the same point. It therefore becomes apparent that, the nature of the parts permitting, they should be placed in a bin or a hopper to be delivered one at a time at a fixed point by a gravity-feed chute. As the result of providing such a chute, two basic operations are eliminated.

It will be shown presently that the motions employed in performing any operation must be reduced to the lowest practical classification to gain the greatest efficiency, and this forms the basis for the positioning of the gravity-feed chute when making the set-up. The delivery point for the part should be as near as is practical to the point at which the part is to be used, and the chute should be placed so that the transport motions are performed over a short path with a wrist or a combination of forearm and wrist motion.

Having done this so that one hand picks up the part quickly and easily, the next thing is to balance the motions of the other hand so as to secure what is known as "two handed operation" if possible. This may be done by arranging for the other hand to pick up another part of the same kind, or by providing duplicate equipment so that both hands perform the same motions at the same time throughout the operation, or in several other ways depending upon the nature of the work. If it is impractical to balance the motions exactly, delays will occur which must be analyzed and reduced to a minimum.

All parts of the operation cycle should be analyzed in the same way that the "pick up small part" element was analyzed. Experience enables the methods engineer to recognize almost instinctively when motion eliminating devices are practicable. Parts which can be handled in gravity-feed containers are usually adapted to "drop delivery". The term is self-explanatory, parts being released by dropping at or near the point of completion and often being carried aside by a chute or a conveyor. This feature eliminates useless transportation and simplifies the motion of re-

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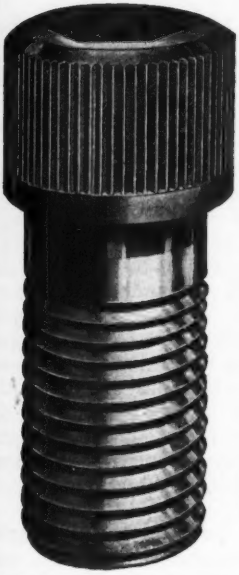

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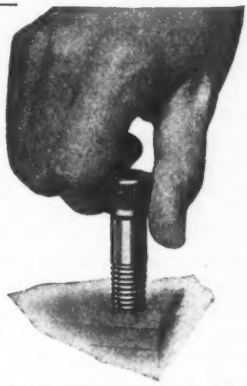

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leasing the part. When parts are machined or assembled in a jig or a fixture, ejectors can sometimes be used advantageously to remove finished parts. These devices partially or completely remove the parts from the jig or fixture and eliminate the motions which occur when the hand has to grasp the parts to remove them.

Characteristics of Motion

All physical motions employed by the human body may be divided into five classifications, as follows:

(1) Finger motions; (2) Finger and wrist motions; (3) Finger, wrist, and forearm motions; (4) Finger, wrist, forearm, and upper-arm motions; (5) Finger, wrist, forearm, upper-arm, and body motions.

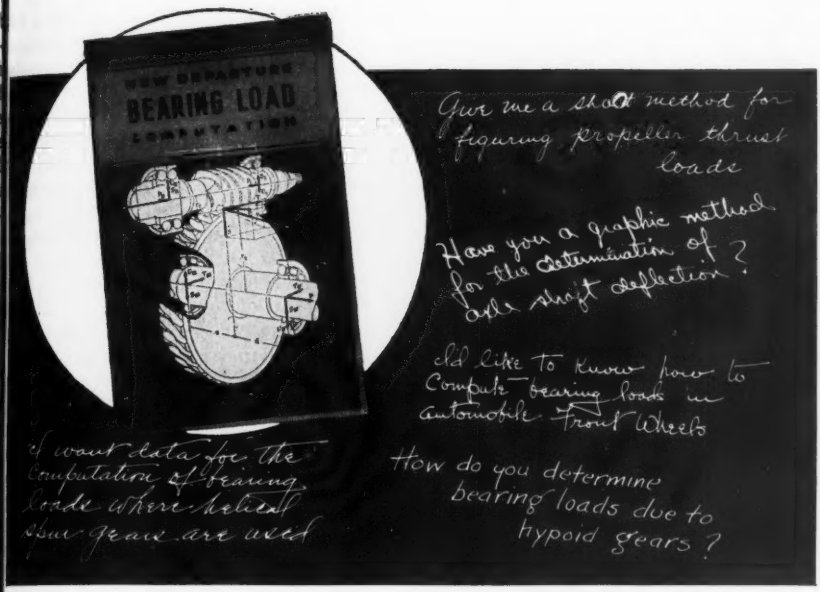
The methods engineer recognizes several sub-classifications, particularly in the fifth class, but the above listing will be sufficient to enable one to visualize quickly the different kinds of motions the human body can make.

Research in the laboratory and the shop has furnished a great deal of information about the characteristics of motions, much of which has practical industrial application. In general, the lower class motions can be made more quickly under light or no-load conditions than higher class motions of the same length. One important exception to the rule is that very short forearm motions made with the hand close to the body can be made more quickly than any other motion. Typists probably recognize this instinctively, for they type with third class motions even when the machine requires a very light touch.

The time consumed in the making of motions in general is influenced by such factors as the skill of the individual, right or left handedness, whether or not the right and left hands are working with balanced motions, the resistance against which the motion is made, the amount of planning required on the part of the operator, and the accuracy of the motion or the amount of control which must be applied to it. Certain motions are influenced by special factors. The control of the forearm motion where the arms acts as a ball and socket joint is influenced, for example, by whether the motion is made in a clockwise or counter-clockwise direction.

Merely to list the factors which must be considered in studying the characteristics of motion would require more space than is allowed for this article, and a description of the known characteristics of motions would require many pages. The information, however, when it is in the possession of a methods engineer, is valuable in a number of different connections and offers an entirely new approach to methods study. Each of the basic divisions of accomplishments becomes more useful in the light of a knowledge of the characteristics of motion, and opportunities for improvement become apparent which otherwise might be overlooked.

Certain average time standards have been worked out for the various kinds of motions. These time standards have several practical applications, and are particularly valuable for determining the relative value of motions when deciding between two or more methods of doing the same job. When the relative value of all physical motions is known, it becomes an easy matter to make efficient workplace layouts. This same knowledge when applied to machine design leads to better designs from an operating standpoint. In the shop, time consuming motions are readily rec-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ognized by anyone possessing an understanding of the relative value of motions.

Every motion made by a worker is affected by two sets of factors which may be classed as direct and indirect. The direct factors are those which are directly related to the work being performed, such as the class and length of motion which must be employed, weight of the part, direction of motion, and so on. The indirect factors are those which affect the motion largely through the mind and muscles of the operator. There are two of these indirect factors: "Plan", and "Control".

Plan is the mental work which accompanies the physical work. When an operator first starts a job, he will have to do considerable planning. On the first piece, he will hesitate often and feel his way along. On the second piece, this hesitation will be somewhat less pronounced. As he produces more and more pieces, hesitations become less frequent, and, in shop parlance, he begins to get into the swing of the work. When a high degree of skill is developed, mental and physical processes alike become habitual, and motions are made in the minimum time.

The amount of control which must be applied to any motion is determined by the accuracy with which the motion must be made. It will require a more accurate motion to insert the end of a piece of thread into the eye of a fine needle than it will to insert it into a 1-inch ring. The factor of control increases the time required for making motions by eight times or more over the time required to make uncontrolled motions of the same type.

An understanding of this makes possible many economies in machine shop work. Assume, for example, that a part is to be drilled in a b jig. If the holes must be center under the drill spindle by controll motions of the operator, a certa amount of time will be required. however, a bar is clamped to the m chine table in such a position th when the jig is pushed up against with an uncontrolled motion, the j is in line with the drill spindle, t time will be reduced to about on eighth of the controlled motion ti Possibilities for savings of this n ture through the use of stops a guides abound in every shop.

Making the Motion Study

The most detailed motion studie are made by taking a motion pictur of the operation and then subse quently analyzing the film frame b frame. In this way, every minut motion may be studied in detail. Th basic divisions of accomplishme employed may be charted and ever possibility for improvement may b considered in detail. A description o the technique of making film analys is beyond the scope of this articl but in general, film analyses uncov many opportunities for improvemen and should be made where quantitie and the nature of the operation justify them.

The majority of machine shop wor probably does not justify the expe diture of the time and money nece sary to make a motion picture motio study. It should not be thought, how ever, that the study of motions shoul be neglected on machine shop work for this is far from being the case Instead, a different technique is use for studying motions; one which i quicker and easier to apply, althoug it is based upon the detailed knowl edge of motions just discussed. In th light of this knowledge, motion stud ies can be made by means of analys and observation which will brin

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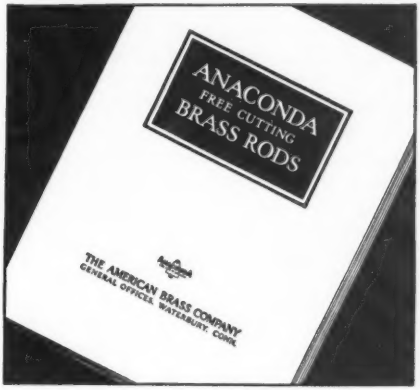

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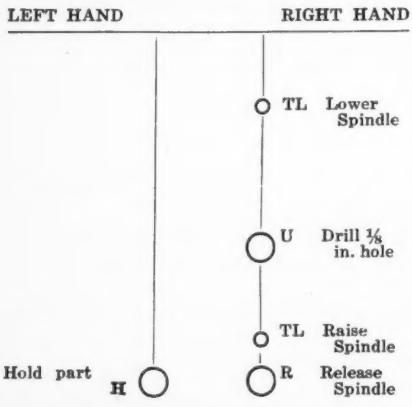
about many improvements in a short space of time.

In making a motion study by analysis and observation, the methods engineer time-studies both together and separately the motions of the right and the left hands. He then by analysis interprets this information in terms of basic divisions of accomplishment and—from his knowledge of the fundamentals of correct motions—is able to recognize and make improvements.

For example, in the study of the operation of drilling the ⅛-inch hole in the part previously discussed, the element "drill" occurs. When the left hand is studied alone it is found that it performs the element "hold part". A study of the right hand shows that it operates the handle of the drill press during this time, performing the elements "lower spindle", "drill", and "raise spindle". The elapsed time for the drill operation is .0008 hour. From this information, the methods engineer draws up the following rough chart in terms of basic divisions of accomplishment.



All elements are similarly charted. An understanding of the relative length of motion times permits dividing the element into basic divisions of accomplishment approximately correctly. A glance at the chart of the "drill" element shows that the left hand performs the "hold" basic operation throughout the element. This is known to be inefficient, and the methods engineer immediately seeks to eliminate it. A simple fixture, otherwise unnecessary, will do this and should be provided if other work can be found for the left hand.

A study of the operation as a whole shows that there is nothing for the left hand to do during this time if the right hand must operate the drill spindle. However, if the right hand can be released from this work, both hands can be occupied in doing other work in connection with getting and laying aside parts. As a result of this study, a fixture is provided to hold the parts, and a foot treadle arrangement is provided for operating the spindle. Thus both hands are freed and the "drill" element as a separate element is eliminated with a saving of .0008 hour.

Opportunities for improvements of this nature are legion in the machine shop. Once made, they are so simple that they usually seem like nothing but applied common sense. It requires systematic motion study upon the part of a trained methods engineer, however, to uncover all of the possibilities for improvement which can be made on any one job.

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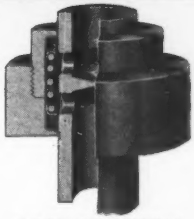

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Built-Up Jigs and Fixtures Offer Many Advantages

By F. J. Burns

BUILT-UP jigs and fixtures of various kinds offer many advantages, among which are economy of production and elimination of time necessary to make patterns and obtain castings. The built-up type of

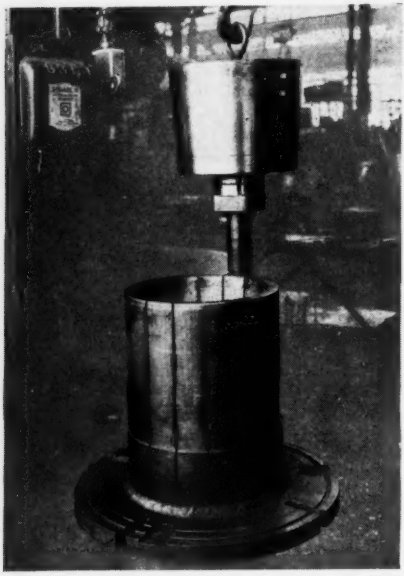

Fig. 1—Boring mill fixture of welded construction.

tool is nothing new, such tools having been employed for many years. Under ordinary conditions, the various parts of such units are fastened together with screws, dowels, and rivets, necessitating a considerable amount of labor to assemble. However, with the rapid strides made in welding during the past 20 years or so designs for jigs and fixtures built up by the welding process have been developed to a point where they show real economy in manufacture.

At the plant of the Lincoln Electric Company, Cleveland, Ohio, the built-up method of jig and fixture construction is used almost exclusively. This article illustrates and describes a few of the tools in daily use at the Lincoln plant.

The unit shown in Fig. 1 is a special turning fixture used on a boring mill for finishing motor frames. In operation, the motor frame is set down over the cylindrical part of the fixture, which is slotted as shown, and the tapered plug is lowered into position in the cylinder, the screw locating itself in a seat leading to a hole with a corresponding thread. The screw is then threaded into the hole, pulling the taper plug down with it and expanding the slotted cylinder, thus gripping the motor frame from the inside and holding it in place. This fixture has a steel base, the slotted cylindrical portion being a section of cast iron pipe. The base is 41 in. in diameter, the body 15 in. in diameter, and the entire fixture is 21 in. high.

As Fig. 1 shows, the cylinder is joined to the base by welding, thus forming a two-piece construction which is as strong as a solid piece. The taper plug is also built up by welding. Recently one of the body sections was accidentally broken off near the base. The broken piece was

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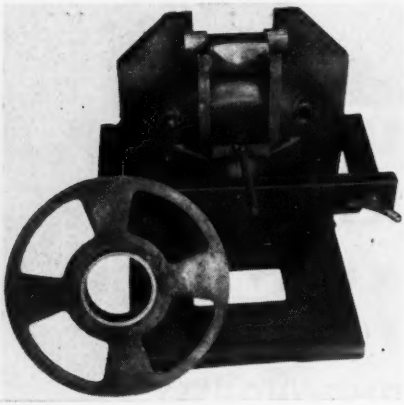

Fig. 2—Built-up angle plate type of drilling jig. This jig was built up of steel plates, welded together.

placed in position, aligned carefully, and then welded in place, making the fixture as good as new in every respect.

In Fig. 2 is shown an excellent example of a built-up angle plate type of jig. This jig is used for drilling one hole in the motor section shown in position in the jig, and is also used for drilling a hole in the part shown in the foreground. The jig is of the quick-acting variety. The work is located by means of two pins and held in place by a strap which is hinged at one end and fastened at the other with a wing-nut. The bushing plate swings upward for convenience in loading and unloading the work. The general dimensions of this jig are 10½x9¼x13 in. high.

The base and upright were built up of scrap steel plate welded together and finished by planing where finish is essential. The two arms that hold the hinged strap are welded to the angle plate upright, while the bushin plate is built up of four pieces welde together. The handle also is welde in place, as shown.

A built-up jig of the box type shown in Fig. 3. This jig was de signed for drilling holes in four di ferent style of dust caps, one of whi is shown in the jig. The jig was bui up from sections of steel plate, and 10x7½x4 in. high. As shown in th illustration, the cover is hinged an locked by a swinging bolt upon whi is a knurled nut. The back of th jig is welded to the base, forming a angle. The two pieces in the angula slots at the top are welded in place also the piece shown in the slot jus above the hinge. The two pieces at the top in the illustration are als welded in place.

The jig shown in the background i Fig. 4 has been turned upside down s

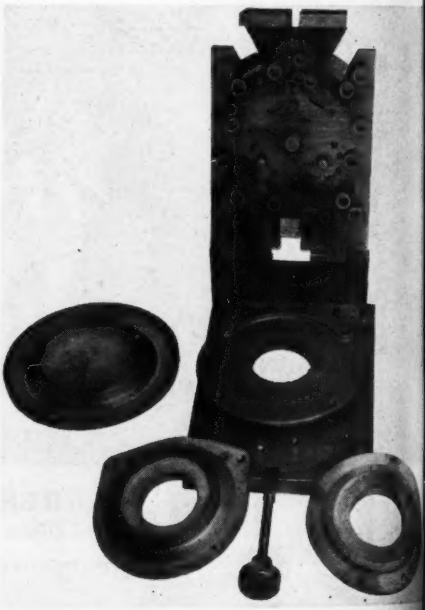

Fig. 3—Built-up welded box-type jig.

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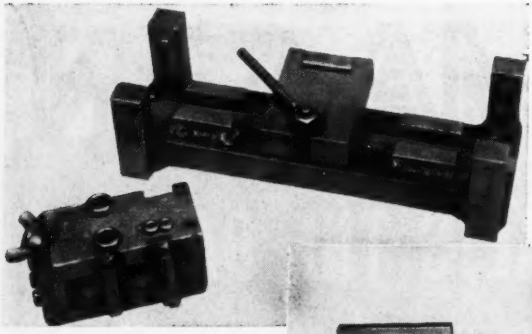
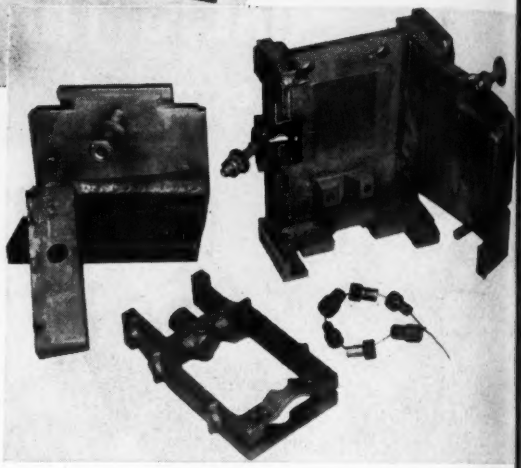


Fig. 4 (Left)—Two drill j... both of which were built ... of steel sections welded ... gether.

Fig. 5 (Below)—The mill... fixture at the left and ... drill jig at the right w... both built up of steel pie... welded together.



that the details of construction can be seen. This jig is intended for drilling holes in shafting, the work being located between four guides and held in place by a strap that is locked by means of a handle nut. The jig is built up of steel scrap and is 3x4½x11 in. The four legs are welded to the base, the four work stops are welded in position, the part which forms one-half of the hinge is welded in place, and the handle is welded to the nut.

In the foreground of Fig. 4 is shown a small box jig, 2x2¼x4½ in. long, designed to hold an angular-shaped piece for drilling 8 holes. The work is locked in place by means of the wing nut at the left in the illustration. This jig is made of steel in two sections that are held together with countersunk screws, making it possible to take the jig apart in order to build up worn locating surfaces, which is done by welding. Welding is also employed to build up the wing head screw and the two stops shown at the front of the jig.

The tools shown in Fig. 5 are used for drilling and milling the regulator frame shown in the foreground of the illustration. The drilling is done in the box jig shown at the right, and the milling operation is performed with the aid of the angle plate fixture at the left. The jig is built up entirely of steel sections welded together. The legs and the three bushing plates on the base are welded in place, and the V-block with which the work is located is anchored in place with screws. The bushing plate is of two-piece welded construction, and is locked in position for drilling by means of the swing clamp shown on the left side of the jig. The milling fixture is built up of two flat steel sections welded together to form an angle, and the work is held in place with the aid of the clamp bar shown lying on the fixture.

Jigs and fixtures of the type under

(Continued on page 68)

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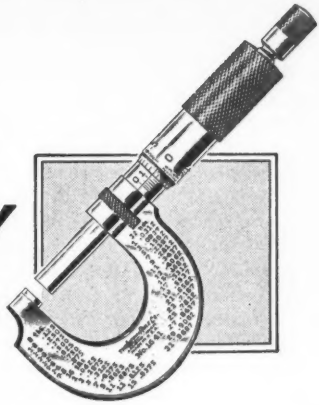

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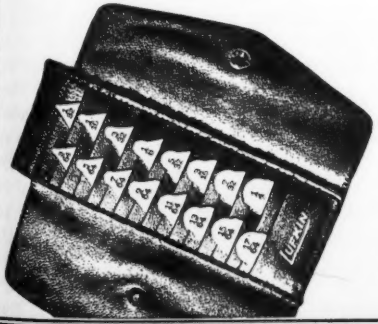

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Safety In Tool Design

By George T. Koch
Chief Die Designer, The Murray Corporation of America.

(Read at 24th Annual Safety Congress, Louisville, Ky., October 15, 1935)

SAFETY is a very important factor in the lives of everyone. It is something that cannot be disregarded without the probability of serious consequences. For this reason, safety engineering has come to play a large part in the manufacture of practically everything useful that is produced today. Consider, for instance, our present up-to-date methods of transportation. We accept them as a matter of fact and enjoy them to the utmost, yet I dare say our enjoyment would be considerably less if it were true that trains, airplanes, steamships, motor buses, and automobiles were produced only at the cost of many lives and much suffering. But this, of course, is not true, for all these things are produced with a minimum of danger and the maximum of safety.

If it were not for safety engineering in our large automobile plants, the manufacturer could not produce a car with the efficiency, accuracy, and low cost that prevails today; thus a good share of that efficiency depends upon the degree of safety with which he can operate his tool and press room equipment.

There is no better place to consider the safety of this equipment than in the designing department. The designer is the originator or—we might say—creator of all these tools, dies and equipment we are talking about, and upon his vision and foresight rests the safety of every individual coming in contact with them. It is possible to add some safety features after the tool has been com pleted, but it certainly is easier an cheaper to incorporate them durin construction. In many cases it is im possible to change the tools or die satisfactorily after they have bee completed, regardless of the cost in volved.

The safe operation of large dies an presses is one of the problems whic we have to face in our shop. One o the first things I am going to discus is press guards of which, as yo know, there are many, many types You are all familiar with some o these types, such as a gate descend ing ahead of the press ram, clearin arms or hands away from the work ing parts of the die before the pres closes. There is the electric butto control type which is so constructe that it is necessary for the operato to individually press an electric start ing button before the press will trip thereby eliminating all danger of h hands or arms coming in contact wit the press while in operation. Then is the type where the operator wrists are shackled and his hands ar automatically and forcibly pulle away from the dangerous parts of th die as the ram descends. There ar numerous others, all effective an helpful in reducing accidents in on of the most dangerous departments in the automotive industry—the pres room.

In my opinion, however, most o these guards and similar safety de vices were created as a result of lac

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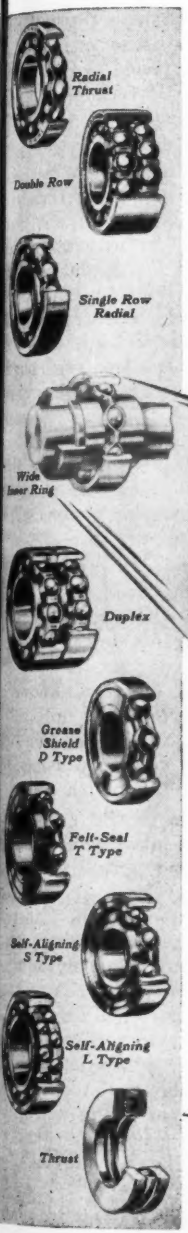

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of "safety thinking" in the designing department. There are several phases to consider in designing for safety, and one important point is the safe handling of the die during the period of its construction.

Some of our draw die rings weigh as much as 10 tons, and they represent only about one-quarter of the die. Provision must be made to handle this tremendous weight in the lifting and machining necessary to build the die. With this in mind, we core holes through side walls for chains, incorporate chain slots in the flanges and clamping lugs for holding while machining, and drill and tap holes in some of the faces for eye bolts for lifting. All these precautions are taken only that the die may safely be handled during construction.

It has been interesting to note how some of our safety problems presented themselves. For instance, we used to allow the toolmaker to tap any size lifting hole he wished to in his die. This practice led to several irregularities; the tap in some cases was too small for the weight of the die, and the tool maker would only screw the eye-bolt thread in one or two turns, with the result that quite a few accidents were caused by the threads of the eye-bolt stripping, allowing the die to fall. This has been entirely corrected by having the designing department specify the size of all holes for lifting and by the use of shouldered eye-bolts, which must be screwed down to the shoulder in all cases.

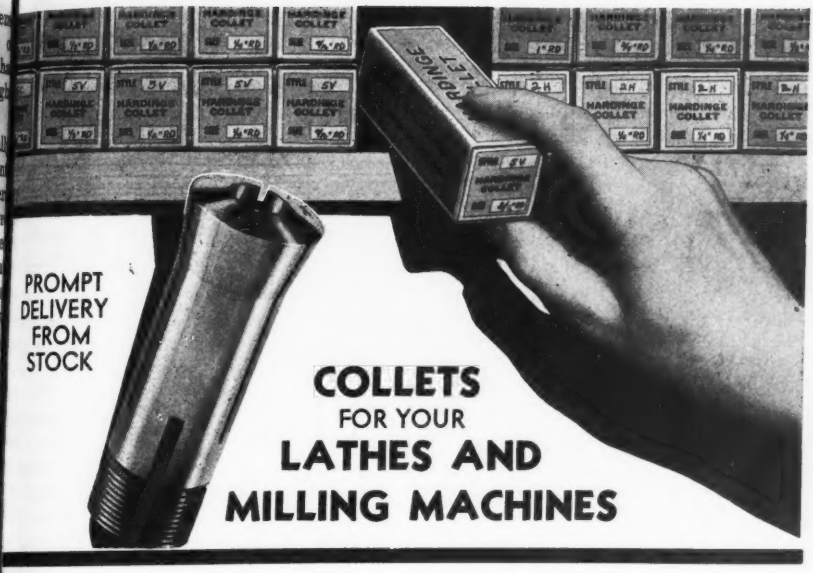
It is not so very long ago that there was no designing department in a die division. Each tool and diemaker made his sketches to his own ideas, built his tools accordingly and was personally responsible for their operation, and in some cases he ran off the production required. He was so closely in touch with the problem at hand, and the safe operation of his die so vitally concerned him, that he just naturally gave some thought to the matter of safety.

This practice, however, gradually declined to the point where it eventually became non-existent. Dies were increasing in size, operations were becoming more complicated, and dies were being built for operations that had always been done by hand or on a bandsaw, rotary shear or square shear. And, more than anything else, the time of construction was cut to a point where costly machinery and the doubling of labor was necessary to complete the tool on schedule. This quickly brought a change in shop practice, whereby designers were necessary and the workmen specialized in the different operations.

The natural result was that very little thought was given to the fellow at the far end—the press operator. The loss of a finger a day was a common occurence in some shops, and press rooms were becoming known as the butcher shops of the automobile industry. The obvious solution was to guard the machine causing the trouble; namely, the punch press.

The draftsmen in the earliest designing departments were practical men who had had actual experience in the shop. They knew the bad conditions that existed and how to remedy them. But as the drafting room continued to expand, largely as a result of the necessity for making tools faster to meet shortened schedules, it became necessary to secure new men—men who were unfamiliar with the troubles and dangers that were ever present in the press rooms. Thus was brought about a condition that did little to help the advancement of safety in the shop.

Guarding of the presses was be



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given more and more consideration, but the dangers, the tremendous cost of accidents, and the human suffering and crippling of men was not brought to the notice of the designer and he, in his ignorance of these conditions, did nothing to improve the safety element of his designs.

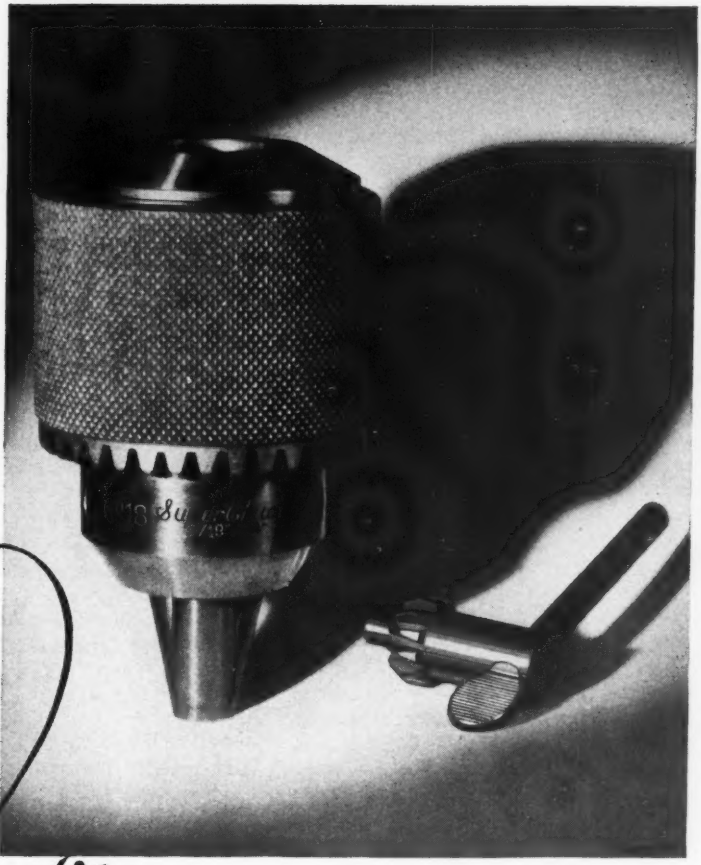
Then the Safety Department began to function. It carried these troubles back to their source, and it kept constantly reminding the designer of his responsibility and of his opportunity to eliminate accidents. It took some time for designers to grasp the value of the Safety Department's recommendations, but I believe that there is not a first class designer at the present time who does not consider safety one of the paramount factors of his design.

The ease with which most of these items could be added was remarkable. For example; in our press room, dies are carried from their storage balconies to the presses by means of overhead cranes. As these balconies are about 16 or 18 feet high and some of the dies weigh as much as 20 tons, you can readily see that there is quite a safety problem involved. It was possible for a die to slide through the chain until we incorporated the chain slots now used in all our dies. They prevented any possibility of the die sliding through, and the cost of this feature, I would say, is practically nothing. The pattern maker leaves off the clamping flange at four places for a distance of four inches and we have the slots permanently. There is a feature of our chain slot that I believe is superior to others used, and that is the fact that we box, or enclose, the lift chain on three sides. If one chain should break, the die would still be supported by the other until lowered to safety.

To increase the safety of handling, the corners are beveled. This is don principally to prevent fracturing the chain links, or, if a rope is use to prevent it from being cut. If th die should be resting on a flat su face, this bevel edge would enable man to get a pry bar under the di without danger of the bar slipping These little features go a long wa to make our dies safe in handling but they still do not make them saf in operation.

It is surprising to see what precau tions are necessary in order to pro tect a man against just plain care lessness or thoughtlessness. For in stance, let us consider a pressure pa of the type commonly used fo stampings where a flanging operation is required and the panel must b held while being flanged. When th press is open, the pressure pad i also open to the extent of its travel This leaves an opening usually large enough for an operator to place hi hands between the bottom shoe of the die and the pad. Then, as the press ram descends, it forces the pressure pad to close and the operator ha been seriously hurt. There isn't any known reason why operators should put their hands there, but they do and that's what we must protect against. A sheet metal guard around the outer edge is sufficient; it is ef fective and costs little.

Now we come to one of the greatest hazards at the die. When a die is set up in a press, the press ram opens the die. It is then necessary to have some sort of a guide to make certain that the halves will close in perfect alignment. If the presses were abso lutely parallel and square in their operation, these guides would not be as necessary, being used only in the setting of the die in the press. But to date we do not seem to have such a perfect condition, so we use what



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are called guide or rider pins in the die itself. These pins are long enough to engage the two halves of the die before they close on their actual fitted sections, thereby assuring a perfect contact as the press and die closes.

In some cases it is possible for us to make the guide pin long enough to be engaged in the other half of the die regardless of the stroke of the press. If this condition is possible, it gives us a perfect condition and eliminates all hazards. But in the majority of cases we are not so fortunate, and the pin disengages the upper half entirely. This makes it possible for the operator to place his hand or arm over the pin, and thus cause a very serious accident.

We have tried various ways and means of getting around this hazard and have finally adopted the use of leather guards to shield the openings. These leathers are fastened to the bushing or female side of the die, projecting down in front of the pin. They are flexible enough to be easily forced out of the way if contacted by any part of the die. This allows us to make them long enough to be always in front of the pin regardless of the length of the press stroke; and still they are stiff enough to prevent an operator from forcing them aside to reach over the pin. They are inexpensive, easily installed, and are the best preventative we have been able to devise.

Similar conditions exist in regard to heels. Heels are necessary wherever there is a thrust between the male and female die. Their function is to lock the die together and counteract the thrust, keeping the male and female in proper alignment. Leather guards similar to those we use on the pins are used in these cases also, preventing an operator from injuring himself by placing his hand o arm over the heel.

The development of these guard for the protection of heels and rider pins has been a fine accomplishmen and has greatly helped in reducin accidents. But the designer shoul go a step further than that. He should consider the press operator and the method of feeding the ma terial into the press and removing the stamping from the die. If he suc ceeds in having all pins and heel out of the way so that the operator or helper does not have to come int contact with them while feeding the sheet into the press or removing the stamping, he has created a much safer piece of equipment. We still insist, however, on the leather guard as an added precaution.

Our die designers have develope two kinds of spring returns for cam slides. In one case the springs are ex posed, and in the other the spring are entirely enclosed in the lower casting. When the pad is closed these springs are under tremendou pressure, and if the stud should break, or the thread should strip they would be freed with terrific force. A pipe and cap can be place over the open spring, adding consid erable protection, but we have found that the enclosed type of pad is the real answer to this hazard. In this illustration you can see that an spring breakage is absolutely harm less, as the spring is always retained in the casting. This method has its disadvantages in spring replacement in case of breakage, and it also cost more than the other type, but we fee that the results are worth the differ ence and so we use it whenever we can.

Of course, it is generally true tha each die will present its own safet problems, and for this reason the d

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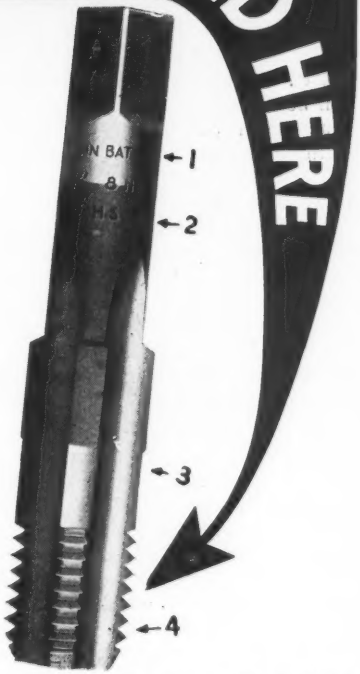

Note the photograph which indicates the four major steps of the BATH process.

1. **Shows the amount of material removed in grinding the shank.**
2. **Shows the unfinished hardened surface as it comes from the heat treatment.**
3. **Grinding on the major diameter. See how sufficient material has been removed from the tap blank so that no hardening decarbonization remains on the tops of the teeth.**
4. **Threads which are GROUND FROM THE SOLID—AFTER HARDENING.**

Briefly, the BATH process provides a grain structure in the teeth just as perfectly heat treated as the core of the tap; complete freedom from "soft" teeth and unsurpassed accuracy. In addition highly polished surfaces, both in the flutes and on the threads, contribute amazingly to their long life.

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signer will create a much safer design if he can visualize his die in operation and the problems confronting the press operator. He will see that all heels and pins are out of the way so that they in no way interfere with feeding and removing stock; that all pins are protected by leather guards and that, if it is possible, the pins are long enough to remain engaged in the die at all times.

He can see how much stroke is required in the press so that the stock can be fed easily and removed safely; that scrap cutters are provided intelligently so that the operator does not have to reach far under the ram to remove surplus material; and that strippers and ejectors are provided so that the panel will not stick and thus can be removed freely. He should consider the method of feeding the material to the die, using on the smaller dies hoppers, rolls, slides, chutes, and other devices to keep the operator's hands away from the die.

On large dies where it is necessary to feed the stock by hand, the loading and unloading sides of the die should be kept clear of any cams, cam slides, unnecessary low hanging or open pads, and unprotected springs. He should see that no surfaces of the two halves of the die come closer together than two and one-half inches, except where it is necessary to form the part, so that the operator cannot injure himself. Thought must be given to the proper supporting of pads so they cannot drop. And there are other angles that must be considered in designing a die for safety.

One important and very gratifying result of employing all these safety devices and principles so far mentioned is the increased productive efficiency of the die in operation. If the die has automatic feeds and ejectors, a small stroke, small shut-height press may suffice; but for all hand-feed long stroke enables the operator get into the die to feed and rem stampings safely, and a larger s height provides clearance enough allow freedom of loading and unl ing. Regardless of how well we design a die, the whole set-up may spoiled when set in a press wi everything is cramped and free of feeding is impossible. It was c monly believed that just enou stroke and shut-height were proper things for securing the gr est production, but this has actu been proved wrong from a produc as well as a safety standpoint.

Whether to clamp or bolt a die the press or not has always bee subject for debate, but in my opi clamping is a dangerous practice it leaves too much to the judgm of the die setter. Bolting the up half to the ram and clamping lower half is not a bad method, bolting both is still better. The f that our dies do not run in the s presses all the time gives us s trouble, but we are after this cla ing business.

I don't care how capable a per the designer may be; there are s points of almost every design i are new and different, and the signer may not be aware of these iations. Unless they are brought his attention, he will continue des ing die after die without these ite believing he is doing a good job.

So if you have any ideas that improve the construction of our in any way to increase safety, red costs, or step up production, by means pass them on so that all us in the stamping industry profit by each other's construc thinking. This cooperation will to eliminate hazards and pro safety as far as is humanly poss

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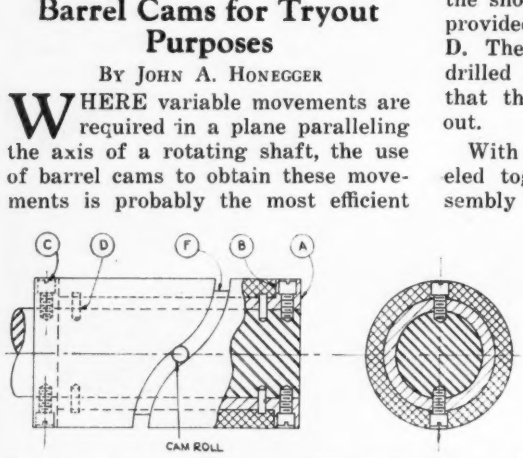
Method of Making Split Barrel Cams for Tryout Purposes

By John A. Honegger

WHERE variable movements are required in a plane paralleling the axis of a rotating shaft, the use of barrel cams to obtain these movements is probably the most efficient and economical method. However, in timing special automatic machinery, it often becomes necessary to remove the cams a number of times for correction purposes before the final path of travel has been determined and this frequently necessitates the removal of other parts of the machine in order to obtain access to the cam.



Drawing showing method of making temporary matrix metal cam for tryout purposes.

To eliminate the additional work and to allow the trial cam to be completed at the lowest possible cost, the barrel cam shown in the illustration was designed. This barrel cam consists of a steel shell **A**, bored to fit the shaft upon which it will be used, and then sawed in half so that the two halves of the shell can be fitted together about the shaft. These halves, or caps, are turned to leave the shoulders indicated at **B** and are provided with screws and dowel pins **D**. The holes for the dowel pins are drilled clear through, as shown, so that the pins may be easily driven out.

With the shells screwed and doweled together on the shaft, the assembly is inserted into a section of steel tubing which is just large enough inside to be a sliding fit for the shoulders **B** and in which a groove is cut to provide access to the interior of the tube. Matrix metal is now poured into the tube and around the shell.

When the matrix metal is cold, the tube is removed, the shaft is placed between the centers of the lathe, and the matrix metal is turned flush with the shoulders **B**. The cam groove **F** is then milled in to suit.

Owing to the relatively easy machining qualities of matrix metal, together with its zero shrinkage and rather high compressive strength, a cam groove can be cut in the material at much less the cost than if cut in a solid steel cam. Should an error be made in the layout of the cam groove, it is only necessary to melt out the matrix metal and recast it to obtain a new cam. The final path of the cam having been determined by experiment, the dimensions can be transferred to a drawing from which permanent steel cams can be made with

the full knowledge that they will be correct.

If it is desired to make the temporary cam durable, however, the cam can be copper plated and then chromium plated, which will give it the ability to withstand a considerable amount of service before wearing.

Where the above method is used, a number of split shell assemblies can be made up and carried in stock to be furnished to the tryout department as required. Interchangeability among the cams is obtained, thus making it possible to change over from one cam to another with the least possible delay.

Before the matrix metal is poured, thin shims are slipped between the contacting surfaces of the shells so that they can easily be separated after casting.

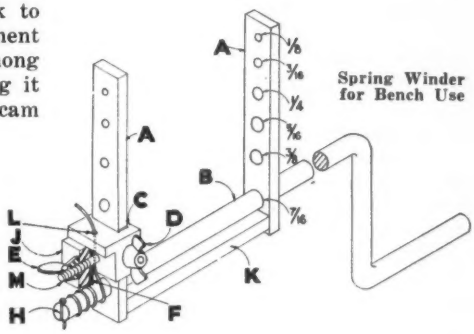
Spring Winder for Bench Use

By Edward A. Healey

THE spring winder shown in the illustration, intended for bench use or where a lathe is not available, has been a very useful piece of equipment in the shop with which the writer is connected. It is especially valuable due to the fact that provision has been made for spacing the coils on a compression spring.

The coiling of the spring is accomplished, of course, by winding the spring about a rod, various sizes of springs being made by the use of various sizes of rods. The winder can be made for any sizes desired, the winder shown being made to take rods from ⅛ in. to 7/16 in. diameter. Each rod may be bent to form a crank at the end for turning, or a separate crank may be made with a bayonet lock, or a lathe dog may be clamped to the rod for turning.

To use, the frame of the device K is clamped in the jaws of a bench vise, then the required size of rod is selected and inserted through the bearing holes in the uprights A-A. The wire is fed to the rod by passing it through the hole L in the wire



Spring Winder for Bench Use

guide C, through a hole in the stud M, and onto the rod, where it is anchored by passing it through the slot H in the end of the rod.

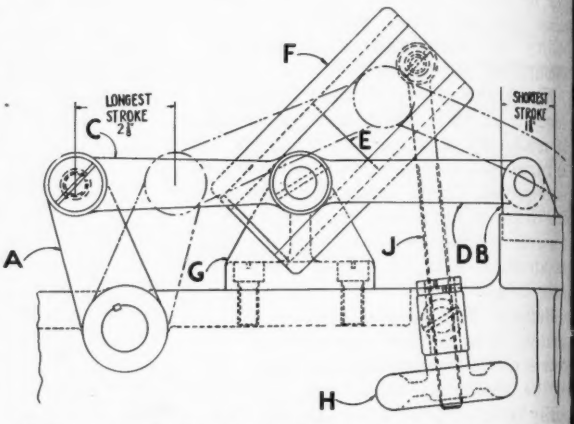
In order to obtain the desired spacing between the coils, the required number of 1/16-in. steel spacing plates are placed in position behind the block J, which is held in position by the stud M and the thumbscrew E. The block J and thumbscrew M are shown in cross-section in the illustration, but the block is made to clear the wire, while the lower edges of the spacer plates, also shown in section at F, should almost touch the rod B. The thumbscrew E should be tightened just enough to pinch the wire very slightly.

One turn is given to the rod, advancing it enough to bring the spacer plates between the windings. With the thumbscrew tightened to give the wire the proper drag, the turning is continued. When the spring has been

completed, the rod is pulled out and the wire is cut.

For winding tension springs, the block C may be locked in a higher position or the spacer plates may be removed altogether. Note that the wire guide block C may be turned upside down for making the smaller sizes of springs where the rod is supported near the upper ends of the uprights.

The winder can be made by any ordinary mechanic and, considering the simplicity of design and construction, is a very efficient tool.



Design of mechanism for varying one point of reversal of a lever-actuated slide.

Adjustment for Varying One Point of Reversal of a Lever-Actuated Slide

By J. E. Fenno

IN REDESIGNING a can-seaming machine to adapt it to a change in product, it was found necessary to provide some kind of an adjustment for varying the stroke of a feed-slide actuated by an oscillating lever. This variation was to be obtained by varying one point of reversal only, since it was essential that the slide start from the same position regardless of the length of the stroke. After due consideration it was decided to interpose the adjustment for varying the stroke between the oscillating lever and the slide, the adjustment replacing the connecting link for these two members. This arrangement is shown in the illustration.

The oscillating lever is indicated at A and the slide at B. The reciprocating movement is imparted from the lever to the slide by means of the links C and D which are joined together by—and turn freely on—the stud in the cross-head E. This cross-head slides in the guide F which is pivoted to the stationary bracket G by another stud. Guide F may be swung to various angular positions by turning the hand wheel H, the hub of which is supported on the machine by the pivoted bearing K. This hub also serves as a nut for the adjusting screw J, which is pivoted to the guide.

The maximum stroke imparted to the slide by the lever A is 2⅜ inches, obtained when the guide F is in a horizontal position. When a shorter stroke is desired, the guide is adjusted by means of the handwheel until the required stroke is obtained.

In the angular position shown, the lever imparts a movement of 1⅛ inches to the slide. This reduction in the initial movement of 2⅜ inches is due obviously to the change in the angularity of the link C and D as the cross-head E moves upward in the

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guide F. The position of these links at the right hand end of the stroke is indicated by the dot and dash lines.

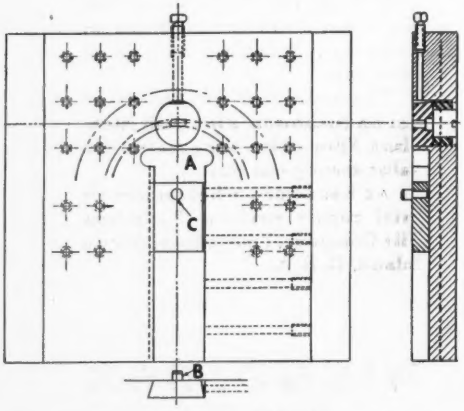
It is important to note that in order that the variation in the point of reversal shall occur at the right hand end of the stroke, the center of the stud pivoting the guide to the bracket G must coincide with the center of the stud in the cross-slide when the lever A is in its extreme left hand position. In this way, at the beginning of the stroke toward the right (regardless of the angularity of guide F), the center of both studs will coincide; consequently the slide will always start from the same point.

Economical Production on "Small Lot" Stamping Jobs

By A. Busch

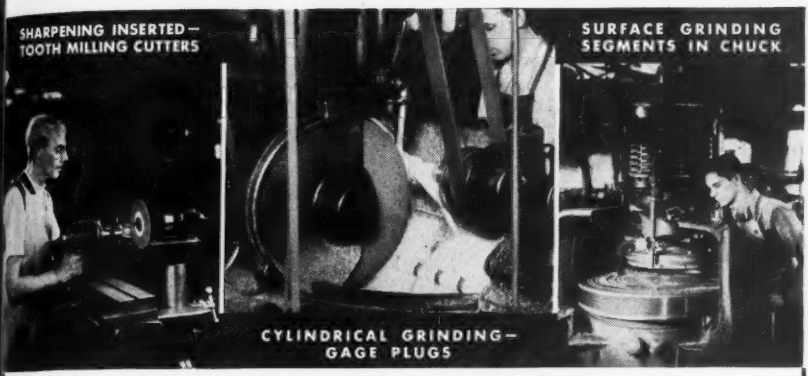
WE receive a large number of "small-lot" stamping jobs that are too small to warrant the expense of blanking dies, so we cut the blanks out by using the sheet metal shears and a universal notching die, and pierce the holes in the blanks with a general purpose piercing die. We have a set of cylindrical dies in a wide range of sizes, so for each size of hole we use one of these dies, set into the die-plate. In the die-plate are rows of tapped holes, as shown in the drawing, to provide means for attaching flat pieces of steel that serve as locating guides for the blanks. The die itself is supported by a screw which provides means for adjustment after grinding.

Orders were received recently for a number of rings of varying diameters. We had no dies with which to punch them out to the sizes required, so we made a nibbling die as shown at A in the drawing. In the plate of the general-purpose piercing die we machined a dovetailed way to fit a slide that carries a center-pin, indicated in the drawing at B. To accommodate different diameters of blanks, the slide is moved from or toward center as required.



Drawing illustrating method of using a universal notching die for producing sheet metal rings.

The job was handled as follows: the stock was first laid out and cut to octagon shape on the shears, then a hole to fit the centerpin on the slide was punched in the blank as shown at C. The blank was then positioned with the pin in the hole and, with the press operating, was rotated by hand so that a circular edge was cut around the blank. When all the blanks of one size were finished to diameter, the slide was set for the inside diameter of the ring and the punch was used to cut out the center. With the press in operation, the stock was rotated as before until the material in the center was separated from the work-piece, which was in the form of a ring. When finished, the edges of the pieces were smooth and symmetrical enough for the purpose



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Hand-Operated Vacuum Lifter for Handling Sheet Metal

By J. W. Greve

THE vacuum lifters shown in the illustrations have simplified the handling of steel sheets in the stamping room at the Westinghouse Electric & Manufacturing Company, and have also helped considerably to reduce stamping costs and speed up production. With one of these tools, the press operator can lift the end or corner of the top sheet of a pile of sheet steel as easily as though it adhered to his fingers.

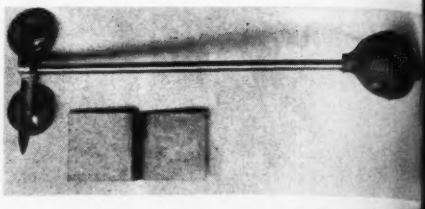


Fig. 1—Hand Vacuum Lifter for Handling Stamp

The lifter shown in Fig. 1 consi of a section of steel tube with a su tion disc on one end and a rubber su tion bulb at the other. The operat grasps the bulb, squeezing it at th same time to force the air out, an drops the disc end onto the shee When he releases the pressure on th bulb, the tendency is for the bulb t

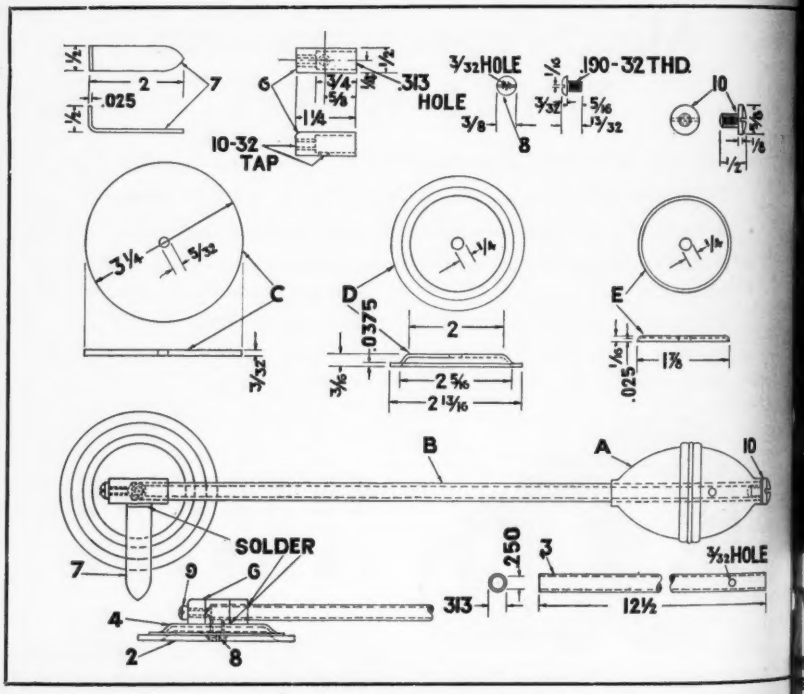
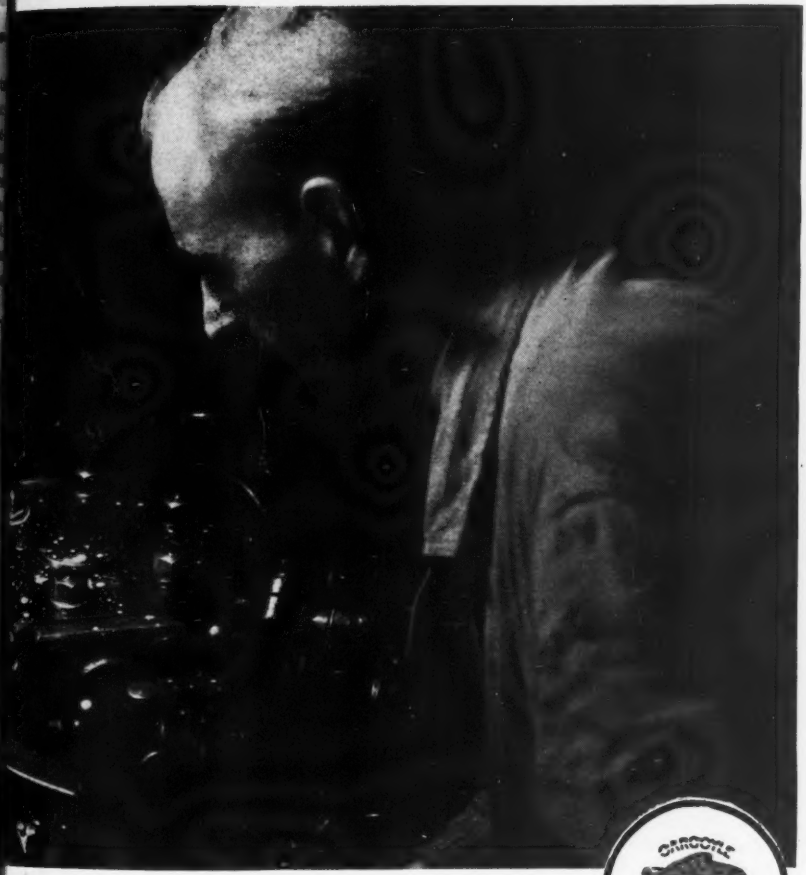


Fig. 2—Drawing Giving Dimensions of Parts Required for Vacuum Lifter.

SAVINGS AND SALES



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"spring" to its natural shape, thus causing a suction which forces the flat steel sheet and the suction disc to adhere to each other.

Fig. 3—This operator is using a vacuum lifter to pull steel sheets into position under the punch.

The lifter shown in the photograph is made with two discs and is intended especially for use in handling work that has partly been formed, as shown. However, one disc is usually sufficient.

The drawing Fig. 2 gives the dimensions for the parts required for the hand lifter. The bulb A is 3¼ in. long by approximately 2 in. in diameter. The tube B is 5/16 in. in diameter, and can be made any length necessary; in the present case it is 12½ in. long. The part C is a steel disc 3¼ in. in diameter by 3/32 in. thick, with a 5/32-in. hole through the center. The piece D is of sheet copper 0.0375-in. thick, blanked to 3⅛ in. diameter and formed as shown. Part E is of 0.025 in. metal, blanked to 2 in. and formed to 1⅞ in. diameter by 0.015 in. deep.

The photograph Fig. 3 shows a press operator handling large steel sheets with a vacuum lifter of much larger size, but which operates up the same principle as the small ha lifter. In this case, however, t lifter is made in the shape of large "U" and extends entire around the rear of the pre both ends coming to the fr so that both hands can be us to operate it. A flexible tu attached to the handle at t right hand end of the tube co nects with a central vacu system and thus provides t necessary suction for lifting t sheets. The suction is contro led by a valve in the handle.

The suction disc is located the center of the "U" at the re of the press, as shown in Fig To assist the operator in lifti the sheets, a coil spring, su pended from a rod that projects fr the press, is attached to the tu When the operator wishes to pull sheet into position under the pun

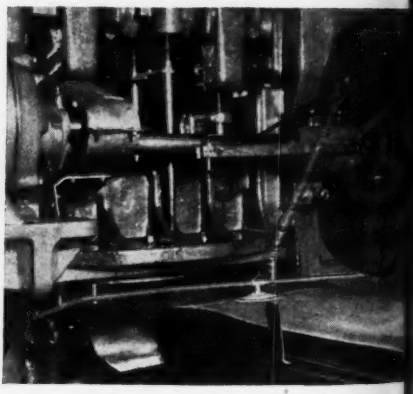
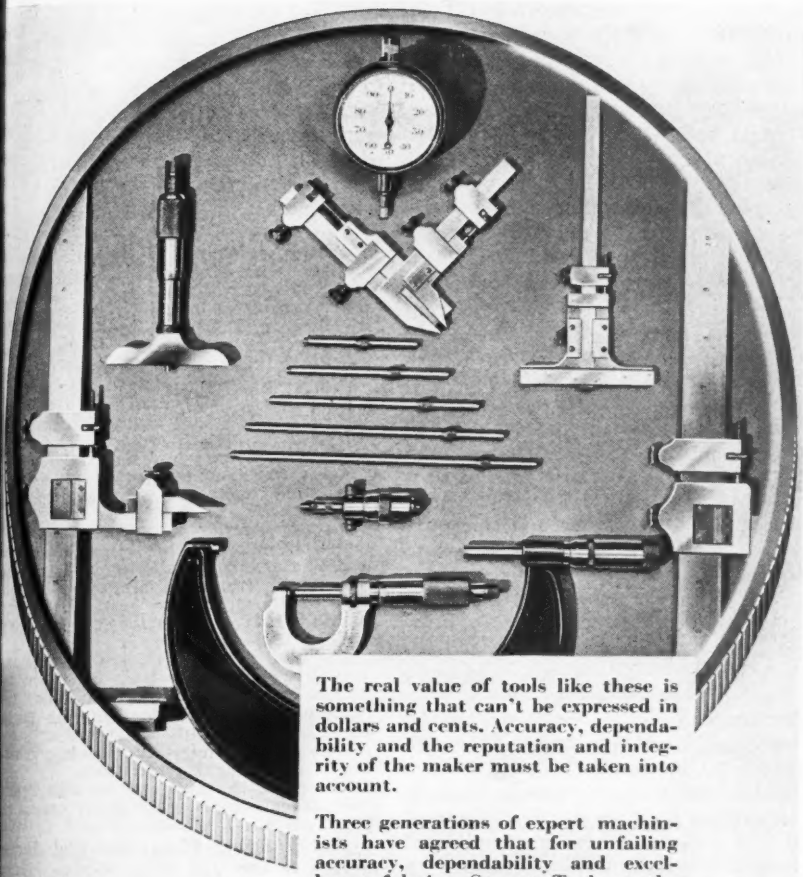


Fig. 4—Rear View of Punch Press, Showing V Vacuum Lifter Raises Top Sheet Off Pile.

he drops the disc onto the shee presses the valve which applies t necessary suction, then raises t sheet and pulls it toward him. Wh the sheet is in position, he releases t



The real value of tools like these is something that can't be expressed in dollars and cents. Accuracy, dependability and the reputation and integrity of the maker must be taken into account.

Three generations of expert machinists have agreed that for unfailing accuracy, dependability and excellence of design, Starrett Tools are the finest that money can buy. Standardize on Starretts when you buy shop equipment tools.

May we send you copies of the complete Starrett Catalog No. 25 "MD" and the Special Dial Indicator Catalog?

THE L. S. STARRETT CO.
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS., U. S. A.

Use
STARRETT TOOLS

6497

valve, releasing the sheet, and then moves the tube back out of the way.

The central vacuum system serves all the presses in this department, of which there are about 125. The vacuum is created by a single-cylinder reciprocating pump having a 9 in. stroke and 6 in. bore. The pump is operated by a 10 h.p. motor. The main line from the pump consists of a 1¼-in. pipe with outlets of 1/16 in. or ⅛ in. to the presses served.

Either one of the devices described above is capable of lifting from 12 to 14 pounds, which is ample to move a sheet of steel stock. A vacuum lifter such as those described here is valuable not only because it enables the press operator to work easier and faster, but also because it makes it possible for him to keep his hands out of the danger zone and thus promotes safety. It is simple in design and can be made at low cost.

Built-Up Jigs and Fixtures Offer Many Advantages

(Continued from page 44)

discussion are often built up by the toolmaker directly from a rough sketch or instructions given to him by the toolroom foreman, entirely eliminating the time usually consumed in tool designing. More complicated designs should, however, be drawn up by a tool designer in the usual manner.

No special appliances are required in building these jigs. In the majority of cases the parts can be held together with clamps during the welding operation, or by tack welding in a few places followed by complete welding after the clamps have been removed.

Compared with the elaborately-finished jigs and fixtures in common use in past years, the tools illustrated in this article may seem crude in so far as appearance goes. However, these tools are accurate as regards the locations of plane surfaces and the holes are bored with extreme accuracy, although the finish is "business finish" only. The essential point is that they turn out accurate work, which is necessary as the products of the Lincoln Electric Company must be made of interchangeable parts.

Firthite Sintered Carbides. This 32-page book, issued by Firth-Sterling Steel Company, McKeesport, Pa., contains complete information concerning the Sintered Carbide compositions made by this firm and known by the trade name of "Firthite." Firthite Sintered Carbides are now made in standardized grades in each of which the balance of the elements of which it is composed has been thoroughly tested. The result is that a special grade has been developed for each particular application, depending upon the type of operation and material, size of cut and speed. Thus one grade is properly balanced metallurgically for machining cast iron and nonferrous metals, another grade is especially adaptable for alloy steels, and still another grade is best for drawing and forming dies, extrusion dies and similar tools.

Included in the book are photographs and drawings of standard tool styles, together with tables of dimensions. Instructions are given for ordering Firthite Blanks or Tips and several pages are devoted to designing, making, grinding and setting Firthite tools.

A copy of the book will be sent to any mechanical engineer or plant executive.

Arc Welding Electrodes and Accessories is the title of a 36-page catalog in which are described and illustrated the complete line of welding accessories made by The Lincoln Electric Company, Dept. M 3, Cleveland, Ohio. Among the products listed are a variety of electrodes each of which has been developed especially for a particular type of job. Of particular interest is the "Toolweld" electrode for providing tool steel cutting edges on ordinary steel and for rebuilding worn tools and dies.

A wide variety of electrode holders are described and illustrated, also protective shields for all classes of work. The "Protective Clothing" section includes welders' gloves, aprons, leggings, and other items of fire-resistant clothing.

A copy of the catalog is available to any mechanical executive upon request.

YES-UP TO 21-INCH BORE!

Rugged giants they are, in their ability to carry loads and stand up to punishing jobs. Yet they have all the PRECISION, the fineness, the friction-free smoothness, of their pigmy brothers in the NORMA-HOFFMANN line. *** And, between the biggest and the smallest, a complete range of sizes is available—each marked by the family quality of PRECISION.*** There's a PRECISION Bearing (ball, roller or thrust) for every load, speed and duty.

Send for the Catalogue . . . Let our engineers work with you

"NORMA-HOFFMANN"

PRECISION BEARINGS

BALL, ROLLER AND THRUST

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

New Shop Equipment

South Bend 9-Inch Lathe

South Bend Lathe Works, South Bend, Indiana, offers to the machine shop and manufacturing trade a new 1936 model 9-inch back-geared lathe designed for small piece production jobs, tool making, instrument making, and all classes of fine accurate work. Featured are ten new improvements, including the twin gear reverse for right and left hand screw threads and automatic longitudinal feeds to carriage, ball thrust bearing for the headstock spindle, a new and improved tailstock, an improved compound rest, a new and heavier designed saddle, and a simplified gearing for threads and speeds.

South Bend 9-Inch Lathe

The lathe is available in 8 different models: six bench and two floor leg, and can be supplied in four different bed lengths of 3 ft., 3½ ft., 4 ft., and 4½ ft. The bed is a strong, rigid, one-piece casting of 50 per cent steel and 50 per cent nickle iron, made with 3 v-ways, planed and hand scraped to 0.001-in. accuracy. Sixty-four major tests measuring to within .001-in. are made on all lathes, insuring accuracy and precision.

Six spindle speeds, three on open belt and three in back gear, are available from 39 to 630 r.p.m. The screw thread cutting range is 14 to 40 per inch. Extra power for heavy work is designated in the optional choice of cone headstock for V-belt drive providing 8 spindle speeds, a two-step double V-belt drive cone providing 4 spindle speeds, and a single-step triple V-belt drive providing 2 spindle speeds. The two latter are particularly designed for production jobs requiring extreme power. Motors up to ¾ h.p. may be used up to their full capacity if the job demands it. The back-gear ratio of 5 to 1 also permits taking the heaviest of cuts when the regular headstock is used. A quick acting bull gear lock allows engaging or disengaging back gear quickly. The new twin gear reverse for right and left hand screw threads and feeds allows an immediate, convenient change. This improvement has the advantage of simplification in that only one compound gear is used for turning feeds. A variety of drive arrangements is offered in the countershaft type and the motor drive types. The drive being featured by the company is the horizontal motor drive shown above. The tailstock is of a new design which provides rigidity. The apron is of strong, powerful construction with the half-nuts made of cast iron, bored, threaded and tested with a master thread gage. The 9-inch lathe has capacity for taking extremely heavy cuts on all kinds of metals. The lathe is furnished with a face plate, tool post, centers, and gears for thread-cutting

No. 2 Footburt Sipps Ball Bearing Sensitive Drilling Machine

The illustration shows the No. 2 Footburt Sipps Ball Bearing Sensitive Drilling Machine which is now being marketed by The Foote-Burt Co., Cleveland, Ohio. The head of the machine has been redesigned in accordance with modern practice but all the better features of the original Sipp design are retained together with a new precision ball bearing spindle, a more efficient idler arrangement and improved appearance.

No. 2 Footburt Sipps Ball Bearing Sensitive Drilling Machine

The machine has a drilling range of from No. 80 to 1¼ in. in cast iron. Solid cone pulleys are used with a straight belt drive, providing four speeds. The unit is powered with a standard constant speed motor. The machine can be supplied in from one to eight spindles and various overhangs to suit the work.

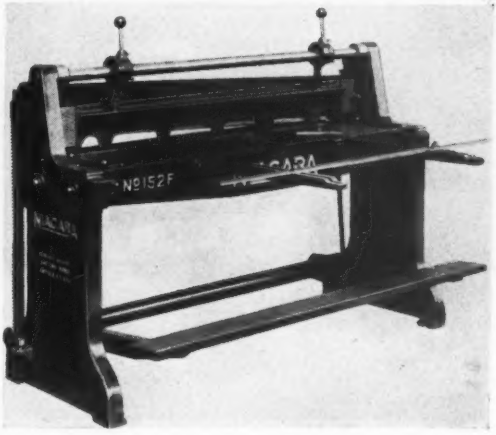
Niagara Series F Foot-Operated Shear

The Niagara Machine & Tool Works, 649 Northland Ave., Buffalo, N. Y., announces a complete new line of Series F foot-operated squaring shears for cutting 16 gauge metal. Easy operation with minimum effort and convenient accessibility, together with smooth, straight, accurate shearing are features which sheet metal workers will welcome.

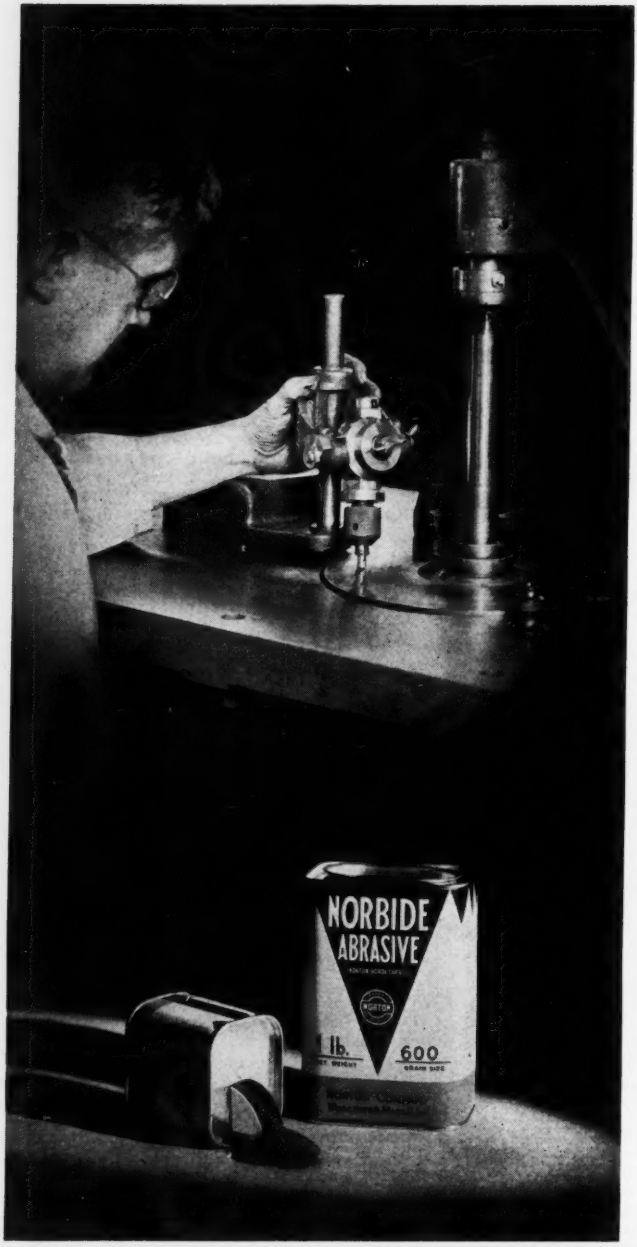
New type, one-piece, closed panel high tensile cast iron housings are designed to assure strength and rigidity and maintain alignment of the working parts. The bed is of channel section, heavily cross-ribbed, and recessed at the center for convenience in handling sheets. The steel holddown is operated manually by self-locking eccentrics and exerts heavy pressure on the sheet to maintain accuracy of shearing throughout the entire length of the cut. The cutting edge is visible to aid in locating the sheet for shearing to a line.

A steel crosshead provides a rigid backing for the knife, the crosshead moving in flat ways with adjustable gibs. Long counterbalancing springs contribute to easy operation by minimizing pressure build-up as the cut progresses. The back gage is strong, rigid, and easily adjusted without the use of wrenches. A patented parallel screw adjustable back gage is furnished on the 96-in. and 120-in. length shears. A lock pin for each index plate locks the gage at the desired setting. A steel graduated scale facilitates gage adjustment.

A new arrangement of the treadle mechanism is said to provide easier operation and improved cutting action. The treadle mechanism has a large tubular cross member which resists torsion or twist and assures equal motion of both ends of the crosshead regardless of the point at which pressure is applied to the treadle. The treadle extends en-



Niagara Series F Foot-Operated Shear



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**NORTON PRODUCTS: Grinding Machines; Lapping Machines. Abra
and Tubes. Non-slip Tiles, Treads and Aggregates. Behr-Manni**

rely across the front of the shear. eries F Shears are equipped with Niag- rs Shear Knives, back gage, front gage, de gages, and bevel gage. They are ailable in cutting lengths from 36 to -in. for 16 gauge and available in 8 nd 10-ft. lengths for 18 gauge.

Delta 7-Inch General-Purpose Grinders

Designed to be completely self-contained, a new line of 7-inch general-purpose grinders has been announced

Delta 7-Inch General-Purpose Floor Grinder

by the Delta Manufacturing Company, 1801 East Vienna Ave., Milwaukee, Wis. The grinders are offered in three models: a pedestal model for the general machine shop, tool room and school shop, available with either single-phase or three-phase motor; a bench model with single-phase motor, and a belt-driven model, incorporating all the advantages and features of the motor-driven models, for shops in districts where the voltage and phase is not standard, and where it is more convenient to belt the machine to an existing motor or drive.

Single-phase motors on the pedestal model may be equipped either with plain toggle switch, or with push-button overload relay switch. Three-phase model is equipped with relay switch as standard.

One of the most unusual features of the new machines is the Twin-Lite Safety Shield, which not only completely protects the operators eyes from flying particles of abrasive, but also incorporates a lighting system that makes the grinder completely self-contained, completely portable, and independent of the shop lighting system. Each shield is equipped for a lamp bulb on each side of the safety-glass shield. These lamps, while casting no glare in the operator's eyes, illuminate both sides and face of the grinding wheel, thus remedying a poor lighting condition that is characteristic of practically all general-purpose grinder installations. The lamps are connected to the motor switch, so that they are on only while the grinder is in actual use.

Extended wheel housings provide plenty of room around the wheels for handling odd-shaped work. Tool supports are completely machined, to insure accurate setting. The aloxite wheels supplied as standard are balanced to within 1/10 ounce-inch, to insure absolutely true, vibrationless running and accurate work.

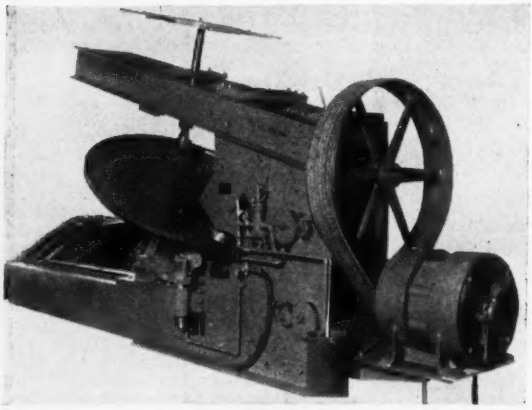
Shafts of all grinders are carried in double-seal New Departure ball bearings, requiring no lubrication during their life. Wheel guards, tool rests, and other parts are designed to conform to safety-code requirements.

Blue Valley Flanging Machine

A new type of high-speed flanging machine for flanging boilers and tank heads, either flat, bilged, concave or round, is announced by the Blue Valley Machine and Manufacturing Company, Kansas City, Missouri. This flanging machine, shown in the accompanying illustration, provides unusually high flanging speeds. Only one minute's time is said to be required for making a 2½-in. flange on a 12-ft. diameter flat head ¼ in. thick.

Overall dimensions of the machine illustrated are 5 ft. wide by 16 ft. long by 6 ft. high. Construction is characterized by simplicity and strength. The flanging mechanism is mounted on the main frame. All operations for flanging are performed through a centralized group of controls located so that the operator has a clear view of the work at all times.

When the flange is completed, the



Blue Valley high speed flanging machine capable of making a 2½ inch flange on a 12 foot-diameter flat head ¼ inch thick in one minute.

working rolls and the center hold-down are backed off, releasing the work. Due to the arrangement of the rolls and controls, flanges are made without any signs of distortion or wrinkling in the finished head, despite high speed operation. The rolls are made of high grade tool steel. All revolving parts are equipped with roller or ball bearings. Power for operating the machine is supplied by a 15 horse-power "Linc-Weld" self-protecting motor, supplied by The Lincoln Electric Company, Cleveland, Ohio.

The Blue Valley Machine and Manufacting Company builds six sizes of flanging machines ranging in length from 10 ft. to 16 ft., in width from 18 in. to 5 ft., and in height from 5 ft. to 6 ft. Capacity of the machines is from 30 gauge thickness, 12-in. diameter to ⅝ in. thickness and 20 ft. diameter. The six machines are powered with ¾, 1½, 7½, 10 and 15-h.p. motors.

Ingels Model C Chicago Elbow Machine

The illustration shows the Model C Chicago Elbow Machine which is now being marketed by Ingels Elbow Machine Corporation, 2636 Fullerton Ave., Chicago, Ill. With this machine the manufacturer states that two men can make 500 elbows in an eight hour day. To operate, the jig is slipped over the finished pipe and in one revolution of the pipe the cutting and beading of a segment is completed. The segments snap together instantly and in another revolution they are closed, thu completing the operation The operation takes les than two minutes, and th beads in the elbow ar locked, one inside the othe so that no amount of rough handling will separate them

The Model C Machine i powered by a ¾-h.p. motor 1160 and 1760 r.p.m., gov erned through a two-speed switch. Power is transmit ted to the crimpers through a three-to-one worm and a 48-tooth worm gear. Th worm gear is connected t the bottom shaft on th machine with bevel gear which run the crimpers on the front of the machine The worm gears are o bronze and the worms ar hardened and ground.

The machine will mak pipe elbows of any kind and it is being used by one firm entirely fo cutting circles on 20 gauge metal an flanging the edge of the circles in one operation. Irregular flanging may b done on this machine or it may be used for crimping, flanging, stitching and wiring.

All parts of the machine are of select ed materials.

Ingels Model C Chicago Elbow Machine

ALL READY FOR YOU •

in Local Warehouse Stocks

Union Cold Drawn Bars—accurate to size and shape, smooth surfaced and straight—are waiting for you in standard sizes of rounds, flats, squares and hexagons at a Union Drawn Distributor's warehouse in your vicinity.

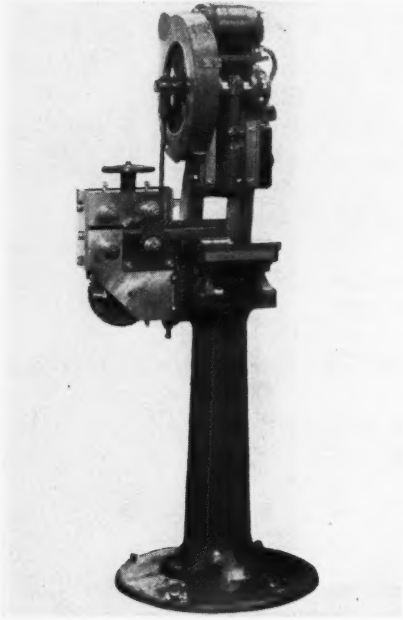
Union Drawn Distributors make it their business to study manufacturers' steel needs and be ready to meet them. They are experts on service—deal with rush orders every hour of the day and fill those orders correctly and on time.

Through the economical service of your local Union Drawn Distributor you can minimize your cold drawn steel inventories and replenish your stocks quickly with exact lengths that meet your requirements.

COLD · DRAWING · PROVIDES · MAXIMUM · MACHINABILITY

Bliss Automatic High Production Press

The self-contained high speed automatic press illustrated herewith has been brought out by the E. W. Bliss Co., Toledo, Ohio, and is one of the smallest power machines built by this firm. The press is a complete self-contained unit in itself, being direct geared to a ½-h.p. motor which drives the press at a speed of 700 strokes per minute. All gearing is carefully protected by metal guards to afford safety to the operator. For the sake of accessibility and the saving of floor space, the machine is mounted on a pedestal of convenient height as shown.



Bliss Automatic High Production Press

The automatic feature is obtained by means of a special type of roll feed that is mounted on the left end of the bolster, which has been especially designed to receive it. The feeding mechanism is actuated by a bell-crank on the flywheel end of the shaft. A screw adjustment on the bellcrank provides for variation in the amount of feed from 0 to 1 in. Positive adjustment of the tandem roller mechanism is controlled through a hand wheel. The feed rolls, which are not visible in the illustration, are attached to the four studs on the side of the feed.

Millholland No. 3 Automatic Drilling Unit

An automatic drilling unit in the design of which cam and hydraulic mechanisms are combined has been announced by Millholland Sales and Machine Co., Indianapolis, Ind. The unit, to be known as the No. 3, has a 3-in. stroke and is powered by a motor of from 1 to 3 h.p. providing capacity to drill up to $1\frac{1}{16}$ in. in steel. The No. 3 unit has the same mounting dimensions as older models, and is intended to permit replacing the older units with the new unit without disturbing base, multiple heads or fixtures.

Cam feed parts in the new unit have been strengthened to increase the capacity of these members. The bronze quill bushing has been lengthened to provide greater rigidity to the spindle. In addition, the spindle quill has overhead support from the return cylinder piston rod, which is piloted in the front and back bushings of the return cylinder.

The return cylinder is now arranged to use a low hydraulic pressure of 1 lbs. For this purpose there is provided an individually motor driven low pressure pumping unit and storage tank which will maintain proper pressure on a number of units. Without changing the return cylinder may be used with air pressure, the air consumption being extremely low due to the fact that the air, instead of being exhausted, is con

Millholland No. 3 Automatic Drilling Unit

UNIFORMITY THAT SPEAKS IN TERMS OF EFFICIENCY

● Every grinding wheel user knows that one of the biggest factors contributing to efficient grinding is the uniformity of the wheels themselves. . . . Our ability to duplicate within reasonable limits has made STERLING WHEELS the choice of both the purchasing and operating departments. . . . For grinding wheels that do your job and do it right day after day in a uniform way . . .

USE STERLING THE WHEELS YOU CAN DEPEND UPON

THE STERLING GRINDING WHEEL COMPANY

Abrasive Division of The Cleveland Quarries Company

Factory and Office: TIFFIN, OHIO CHICAGO: 133 N. Wacker Drive DETROIT: 101-107 W. Warren Ave.

STERLING ABRASIVES

pressed back into the line by the forward movement of the spindle, providing the effect of a spring. The cylinder is brass lined and all cup retaining parts are of non-corrosive materials to prevent deterioration due to water in the air line.

The motor mounting takes any make of foot type motor, with standard NEMA dimensions in frame sizes 224 and 225. Two types of mountings are available; one for ¼ reduction from the motor speed and the other down to $\frac{1}{16}$ through back gearing. The unit has high speed capacity up to 3000 r.p.m.

Cam operation permits cycle operations up to 60 per minute or down to one minute or more per cycle. The cams are of hardened steel plate and are inexpensive to replace. Different leads can be cut on one cam so that operations can be combined. Cams and feed gears are readily changed, being easily accessible on either side of the body. Spindle speeds can be changed by changing the gear on the motor shaft and the spindle gear.

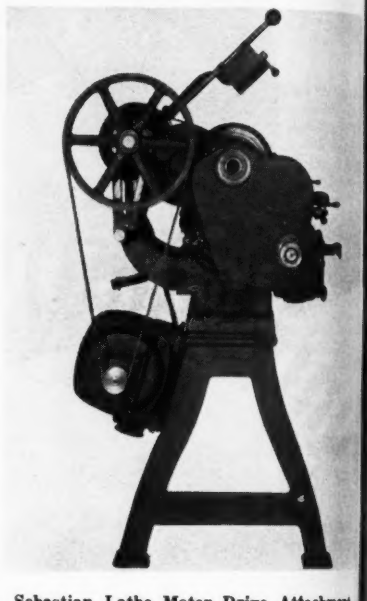
The unit can be mounted either horizontally, vertically, or at any angle. A flanging quill for mounting multiple heads is standard equipment, but a No. 2 or 3 Morse taper can be supplied for single spindle work. The No. 3 unit can be furnished with a milling head for sawing, facing, or end or straddle milling.

Sebastian Lathe Motor Drive Attachment

The illustration shows a lathe equipped with the motor drive attachment that is now being marketed by the Sebastian Lathe Company, Cincinnati, Ohio. This attachment can be attached to any make of cone head lathe to convert it into a motor driven unit. The motor can be mounted on the lathe leg as shown, or on the floor immediately under the rear of the lathe. The motor drives a pulley on the end of a shaft that is mounted in a bracket at the rear of the lathe. The countershaft pulley being mounted on the attachment shaft, the drive to the lathe cone pulley is completed by running a belt around the two cone pulleys.

The attachment bracket is held in place by means of a plate which is attached to the rear of the lathe bed by means of screws. A lever, conveniently located, provides a spring tension which may be released to change the belt speeds. The control switch is also conveniently located and the drive will not obscure the vision. Power is transmitted to the attachment cone pulley by means of a V-belt from the motor pulley to a large pulley on the end of the attachment shaft.

The cone pulley belt can be maintained at the proper tension by means of a one-screw adjustment. Bracket bearings are of the anti-friction variety and the location of the bracket elimin-



Sebastian Lathe Motor Drive Attachment

ates vibration. The bracket is made in three sizes, for lathes of 8 to 12-in. swing, and 17 to 20-in. swing, using motors of ½ h.p., 1 h.p., and 2 h.p. respectively.

Baldor 12-Inch Bench and Pedestal Grinder

The Baldor Electric Company, 4357-4359 Duncan Ave., St. Louis, Mo., announces the addition of a 12-in. bench and pedestal grinder to the present line of grinders made by this company. The grinder is powered with a heavy duty motor of either 2 h.p. or 3 h.p. as required. The motor is equipped with ball bearings and is dynamically balanced to eliminate vibration. The bearings are sealed in special housings to prevent the

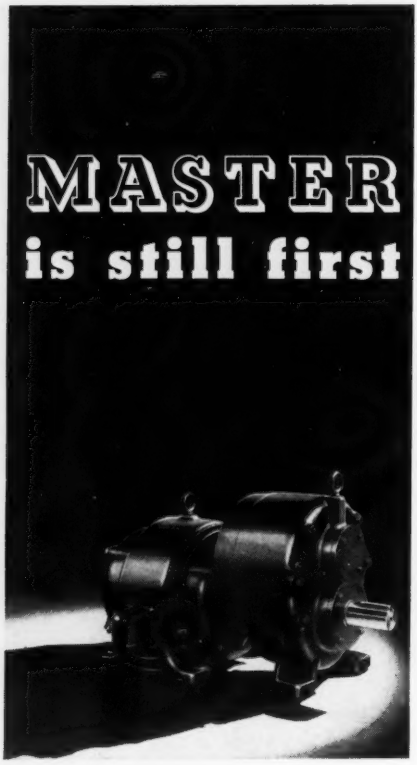
WE MADE THE SPOKES AND RIMS FOR GRANDPA'S BIKE

Eight . . . nine . . . even ten miles an hour! Gosh, how he burned the dust! Speed was in the making. Stronger! Safer! Lighter! Such were the cries of the day . . . so we replaced ash and oak with STEEL. True, spokes were pencil thick and rims were clumsy. They were just the beginning. Today, bicycles, motorcycles, automobiles and airplanes, most modern of the modern, use Wissco Wire and Wissco Strip of unbelievable strength, perfect in section and finish. Wissco Wire has developed with, and even ahead of product requirements. Don't you want to know of the Wissco Wire that's awaiting your demands?

WICKWIRE SPENCER STEEL COMPANY
New York City, Buffalo, Chicago, Worcester. Pacific Coast Headquarters: San Francisco. Warehouses: Los Angeles, Seattle, Portland. Export Sales Department: New York City.

Wickwire Spencer manufactures High and Low Carbon Wires—in various tempers, grades and finishes—or your specific purpose. Hard-Drawn, soft or annealed Basic or Bessemer Wires—Hard-Drawn annealed, or oil-tempered Spring Wire, Chrome Vanadium Spring Wire—Valve Spring—Music—Clip—Pin—Hairpin—Hook and Eye—Broom—Stapling—Bookbinding—Machinery Spring Wire—Reed Wire—Clock—Pinion—Needle-Bar—Screw Stock—Armature Binding—Brush—Card—Florist—Mattress—Shaped—Rope—Welding. Flat Wire and Strip Steel, High or Low Carbon—Hard, annealed or tempered—Clock Spring Steel—Corrosion and Heat Resisting Wires. Consult the Wissco technical men on your wire problems, however large or small.

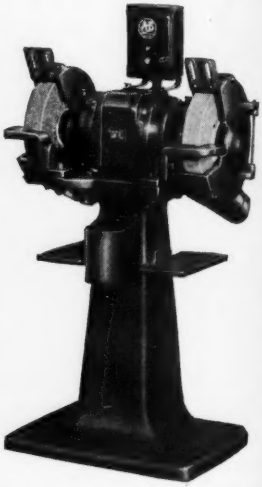
WISSCO WIRE
by Wickwire Spencer



More than ten years ago Master pioneered the first integrally built Geared Head Motor. Each year since that time more Geared Head Motors have borne the Master nameplate than any other. What better recommendation could even the shrewdest buyer have than the continued preference by the majority for Geared Head Motors built by Master?

THE MASTER ELECTRIC COMPANY
DAYTON OHIO U S A

entrance of dirt. The grinder is equipped with exhaust type cast iron guards, adjustable tool rests which can be tilted for angle grinding, a water pot, tool

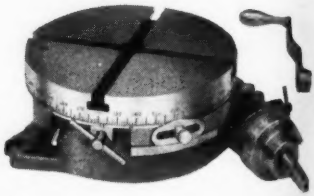


Baldor 12-Inch. Bench and Pedestal Grinder

trays, cord and plug, and starter. Tool rests are adjustable for the wear of the wheel, and the guards are easily removed for buffing.

Stevens 7½-Inch Rotary Table

The accompanying illustration shows a rotary table that has been brought out by John B. Stevens, Inc., 306 Hudson St., New York, N. Y., to meet the demand for a rotary table of small diameter and minimum height for use on horizontal

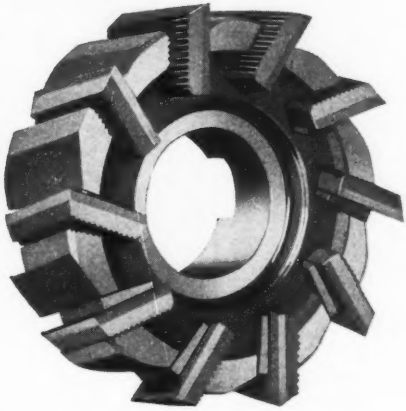


Stevens 7½-Inch Rotary Table

and vertical millers, slotters, and other machines.

The worm gear by which the rotary motion is imparted to the table is

OUR DESIGN IS THE RESULT OF YOUR EXPERIENCE WITH MILLING CUTTERS



The most economical ratio of adjustment of side and peripheral cutting edges is established by the job itself.

That is why the adjustment of

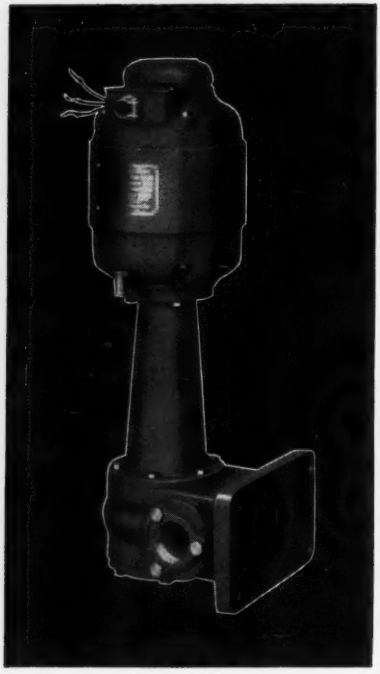
GD & GD

Inserted serrated blade milling cutters is not limited by mechanical construction.

GODDARD & GODDARD CO.

DETROIT, MICH.

LONG, DEPENDABLE SERVICE



Ruthman Gusher Pumps are built by pump specialists—Designing and building efficient, compact, long service pumps for installation on machine tools and other uses is our business.

When you specify Ruthman's on the equipment you buy, or replace old pumps with new Ruthman Gusher Pumps you are sure of getting long, dependable service from them.

Write to us for recommendations

GUSHER COOLANT PUMP

THE RUTHMAN MACHINERY CO.
536 E. FRONT ST. CINCINNATI, O.

Don't Let the Boss Catch You Reading This!

(That's the heading of the introductory page of Koebel's famous instruction booklet "For Men Only".)

Here's a good opportunity for you to slip one over on the boss. Read this booklet carefully when he isn't looking; then some day you'll surprise him with your knowledge of wheel dressing technique.

The vital facts are all boiled down for quick reference—a handy dressing manual for grinder operators. Reading time complete, exactly 15 minutes. May it make you worth more to your boss.

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KOEBEL DIAMOND TOOL CO.
1202 Oakman Blvd., Detroit

KOEBEL
DIAMOND TOOL

eel and is very large in diameter for a ble of this size. The method of engag- g the worm and worm wheel insures tal absence of lost motion. All parts ove in an oil bath. The worm and orm wheel can be readily disengaged to ermit swiveling the table by hand, and hen indexing direct, divisions of 2, 3, 6, 8, 12, and 24 can be obtained by eans of a vertical lock pin which en- ges stations laid off to these divisions the underside of the table. This fea- re simplifies the machining of squares, tagons, and other parallel cuts. The ble can also be bound at any point. The edge of the table is provided with 0 graduations for reading in degrees, ith an adjustible zero line, while the orm shaft is provided with an adjust- le worm collar having 225 graduations, ch graduation providing a one-minute ading.

The diameter of the table is 7½ in. nd the height is 3¼ in. The diameter the hole through the center of the ble is $\frac{13}{16}$ in. and the width of the -slots is $\frac{7}{16}$ in. Net weight, 42 pounds.

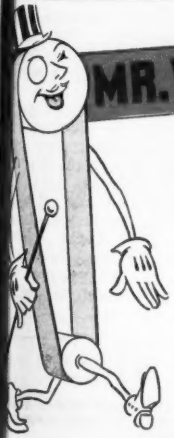
G-E Electric Thickness Gage

An electric thickness gage, developed r measuring the thickness of porcelain amel, paint, or other nonmagnetic materials such as celluloid, glass, mica, etc., which have been applied to or laid on flat sheets or plates of steel or iron, has been introduced by the General Electric Company, Schenectady, N. Y. The gage permits quick and convenient

G-E Electric Thickness Gage

measurement of the thickness of the material not only at the edges but in the middle or any other place where a flat surface slightly more than an inch in diameter can be found. Weighing only 7½ pounds complete, it can be used portably wherever a 110-volt, 60-cycle power supply is available.

The new instrument consists of a small indicating unit enclosed in a neat cast-aluminum cabinet, and a ½-pound



MR. WELL DRESSED BELT

STEPS UP DELIVERED H P

5%—25% increases in delivered HP have been reported by plants dressing their belts regularly with Research Belt Dressing—the dressing made by the men who make Research Belting. Ask your distributor about it or write direct to the Home of Research.

GRATON & KNIGHT CO. WORCESTER MASS....

RESEARCH BELT DRESSING

from the Home of Research

QUART $1.00

½ GALLON $1.50

GALLON $2.75

5 GALLONS $12.50

gage head connected to the unit by cable. When the face of the gage head is held in contact with the surface of the material to be measured, the thickness can be read directly on an indicating instrument mounted on the front of the cabinet. Because of its light weight, the gage head can be moved readily to any point on the surface and the corresponding measurement conveniently taken.

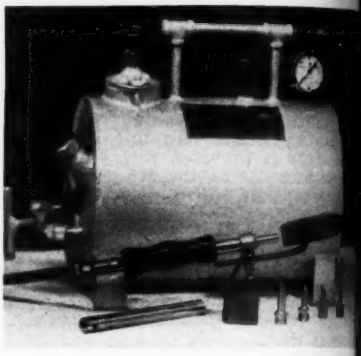
In use, the indicating instrument is first adjusted to read correctly with a known thickness of insulating material or a known air gap between the gage head and a sheet of steel or the same kind and of approximately the same thickness as that used with the material being measured. It can then be used to indicate the thickness of enamel within the range for which it has been set.

Thickness ranges of 1 to 5, 2 to 10, 5 to 25, 10 to 50, and 20 to 100 mils can be obtained. A separate scale on the indicating instrument is required for each thickness range. Either single- or double-range indicating units are available, the latter combining any two of the standard ranges. For measuring the thickness of nonmagnetic metal platings on steel, and of other materials of less than 1 mil in thickness, a unit of modified design can be obtained.

"Ace" Portable Soldering, Brazing, Melting and Heating Outfit

A complete portable soldering, brazing, melting and heating outfit which makes its own gas without pumping or preheating has been placed on the market by Reiner & Campbell, Inc., 242 Lafayette St., New York, N. Y. The source of the gas is the well known combination of water and carbide which are obtainable practically anywhere. The generator, shown in the illustration herewith, is only 10 in. high and 13 in. in leng and comprises an ideal outfit for eith inside or outside work.

To charge, the tank is filled wi water up approximately to the spo level, carbide is placed in the draw and the gas begins to form instant ready for use. One filling of water sufficient for three charges of carbi



"Ace" Portable Soldering, Brazing, Melti and Heating Outfit

and the recharging may be done whil the outfit is in operation. The cost o operation per day for ordinary solderin light brazing, or torch work, is said t be from 10 to 12 cents.

The iron is heated in from one t two minutes and can be regulated t any desired heat, no matter how ligh or heavy the work. By removing th copper from the handle, the torch ma be used for melting or burning off solde or paint, and any size or shape of co per may be used. The flame is clea and makes neither smoke, dust, dir nor sparks. The torch is equipped wi needle regulation and a fresh air feed

STEVENS ROTARY TABLES

7½ in. Rotary Table for Small Miller Tables

Table graduated for single degree reading and worm shaft collar for readings in single minutes.

Worm can be disengaged for turning table by hand.

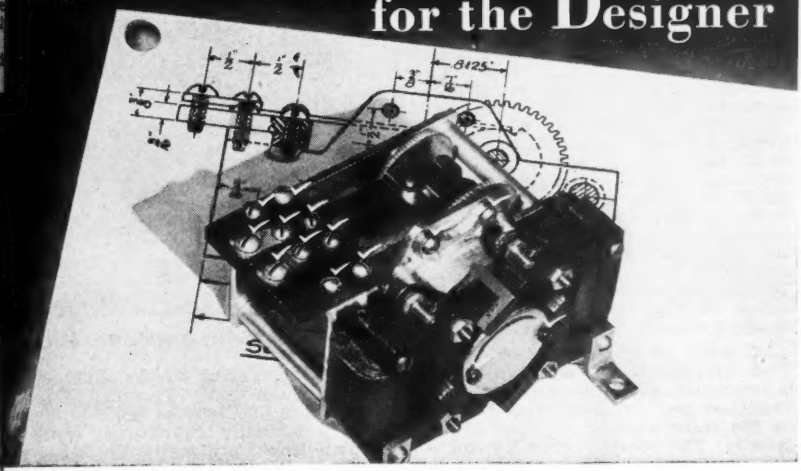
Vertical lock pin provided for divisions of 2, 3, 4, 6, 8, 12 and 24. Other sizes 12" and 18" diameters.

Send for circular.

JOHN B. STEVENS INC.

306 HUDSON ST., NEW YORK, N. Y.

CHALK ONE UP for the Designer



—He saved 25% on these Timer fastenings by specifying Self-tapping Screws

Use bolts and nuts here . . . use machine screws in tapped holes here." It would have been easy for the designers of this Timer to write that hasty and conventional assembly specification after completing the electrical and mechanical features. However, assembly methods received careful instead of hasty consideration. And the result was a 25 percent saving on the fastenings!

Comparison showed that adoption of Parker-Kalon Type "Z" Hardened Self-tapping Screws instead of machine screws would eliminate the costly operation of tapping the brass parts. Also that these same unique Screws would save time and labor as compared with bolts and nuts for fastening contact springs to the Bakelite panel. Cheaper to use for both assemblies, the Type "Z" Self-tapping Screws made the assemblies stronger, too. *They always hold better under tension, shear and vibration than machine screws in tapped holes, or bolts and nuts.*

Many designers and production heads make it a practice to consider Self-tapping Screws whenever a fastening problem arises. While these Screws will not make every fastening cheaper and stronger, records do show that *in seven out of ten cases they provide a better job for less money.* So high an average of success makes it important for you to investigate the opportunities on your own jobs. Do it now. Send a brief description of one or more specific fastenings with the coupon. We'll furnish FREE samples of the correct type of Self-tapping Screw for a trial, with recommendations of our Assembly Engineers.

PARKER-KALON
HARDENED
Self-tapping Screws
PAT IN U.S AND FOREIGN COUNTRIES

Where and How to use:-

Type "Z" Hardened Self-tapping Sheet Metal Screws

For joining and making fastenings to sheet metal up to six gauge: aluminum, die castings, Bakelite, etc. Simply turn Screw into drilled, pierced, molded hole. It forms a thread in the material as it is turned in. Can be removed and replaced.

Type "U" Hardened Metallic Drive Screws

This type of Self-tapping Screw is used for making permanent fastenings to iron, brass and aluminum castings, steel, Bakelite, Durez, etc. Hammer Screw into a drilled or molded hole. It forms a thread in material as it is driven.

Parker-Kalon Corp., Dep. M, 198 Varick Street, New York
Send samples of Self-tapping Screws suitable for fastenings described on attached sheet.

Name .....

Company .....

Address .....

Parker-Kalon Products are sold only through recognized distributors

device. The regulation is automatic and each time the torch is used, the tip is cleaned.

Electro-Graphic Graver

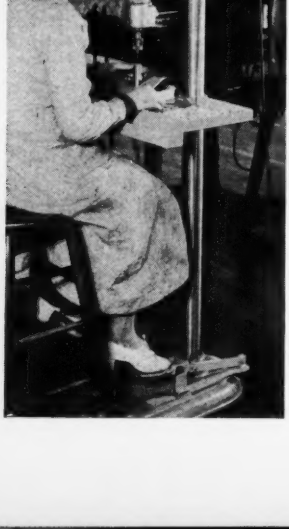
An electric engraving tool with which letters, figures, or characters of any kind can be engraved on any metal surface from the softest to the hardest has been developed by the Electro-Graphic Graver Company, Factories Bldg., Toledo, Ohio. The Electro-Graphic Graver is an electrically actuated tool having a combined electrical and mechanical action. The electrode has a reciprocating motion which is actuated when the electrode comes in contact with the work. This combination, in addition to the electric arc, produces a serration when in contact with the metal to be marked. These lines or serrations can be produced on any metal surface, regardless of the hardness of the metal.

No acids or other accessories of any kind are needed. To use, the instrument is connected with the electrical circuit, then the user proceeds with the graver in the same manner as with a pen or pencil. The graver operates on any suitable source of electrical energy, either alternating or direct current proper voltage. The alternating curre type plugs into any standard 110 v

Electro-Graphic Graver

60 cycle lighting circuit outlet and co sumes less than 75 watts.

The A. C. type of unit is compris of a specially constructed transform with three output terminals and a fi point dial switch, forming a combin



TAP TWO THOUSAND 9-36 THREAD PER HOUR IN STEEL WITH ATLA

The Reynolds Electric Company, prominent electric product manufacturers of Chicago, find Atlas Dr Press equipment efficient and economical. They a tapping between eighteen hundred and two thousa 9-36 threads per hour in steel with an Atlas Model 1 The press is running full time.

SMALL INVESTMENT DOUBLES PRODUCTION

Its purchase represented a very large saving, t price being only a fraction of other equipme considered. On this same Atlas, Reynolds is no doing in two hours a tap job that formerly require five hours on a regular tapping outfit.

Atlas Drill Presses are standing up under this a many other similar jobs and maintaining their a curacy. They will do the same in your plant. Ma in four sizes, bench and floor models. Prices ran from $14.45 to $39.45. See them at your jobbers write direct for new 1936 catalog.

ATLAS PRESS COMPANY

1846 N. Pitcher St. Kalamazoo, Mic

Complete display at Atlas Sales Co., 35 E. Wacker Dr Chicago

tion of 15 selective stages of current supply to select from in addition to the 15 selective power stages. The instrument is provided with a Vernier adjustment for the armature core mechanism. With this arrangement of adjustments an unlimited selectivity of current stages are available. The A.C. power unit and graver are housed in a finely finished 8x8 in. steel carrying case. The complete instrument weighs 12 lbs.

The direct current type graver works equally well on direct current with proper voltage control. In using four No. 6 dry cells or a standard voltage battery in conjunction with the specially constructed resistor bridge control method, the D.C. outfit is said to be very economical. Like the A.C. type, this instrument is also housed in a neat steel carrying case.

The electrode is of a special type of tungsten alloy. It will stand very hard use and with proper care will last indefinitely. Work leads are of the finest quality, extra flexible material. To each end of the leads are attached especially designed friction connectors which fit snugly and firmly, yet are quickly and easily detached. The power unit is constructed throughout of first quality materials. The adjustments of power output stages are so arranged as to enable the operator to make any desired adjustment from the finest to the heaviest serration very quickly. The D.C. outfit weighs less than 15 pounds.

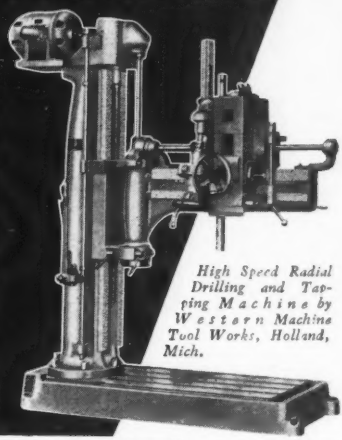
"Welco" Electro-Mechanical Timer for Spot Welding Machines

The Welding Timer Corporation, 251 Ogden Street, Newark, N. J., announces an electro-mechanical timer for spot welding machines. The device consists of an electronic timing element and a set of balanced contactors specially designed to handle the high overloads encountered in spot welding.

The Welco Timer permits spot welding at times as low as one cycle. Timing accuracy of less than ¼ cycle, plus or minus, is guaranteed at one cycle operation. At slower speeds, for example, between 20 and 30 cycles, any reasonable accuracy can be assured, even up to 2 per cent plus or minus. Timers for longer times may be had on special order.

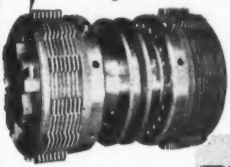
Standard settings cover a range of from one cycle minimum to 30 cycles maximum. Dial settings permit infinite variation of times between maximum and minimum. Accurate timing at between one and two cycles, easily ac-

✓ EASIER CONTROL
✓ MAXIMUM POWER
✓ SIMPLER OPERATION
✓ SPEEDIER PRODUCTION
✓ GREATER PRODUCTION



High Speed Radial Drilling and Tapping Machine by Western Machine Tool Works, Holland, Mich.

This exceptionally fast driller and tapper, 2000 rpm of spindle, is equipped with Multiple Disc, Close Coupled Model, Twin Disc Clutches. Entirely enclosed and running in oil, these clutches operate at a constant speed, transmitting maximum power at any spindle speed. Operated from in front of the head, by the Western ball handle lever control, the Twin Disc Clutches not only insure easier operation, but speedier and greater production. Engaging either one of the clutches, located in the bevel gear, with this control gives forward or reverse direction to spindle. This is outstanding simplicity of operation. Write for specific recommendations. Engineering data on request. **Twin Disc Clutch Co., 1326 Racine St., Racine, Wis.**



Close Coupled Duplex Oil Type Clutch

TWIN DISC CLUTCHES

QUALITY
CLIPPER
BELT LACING

Clipper Carded Belt Hooks

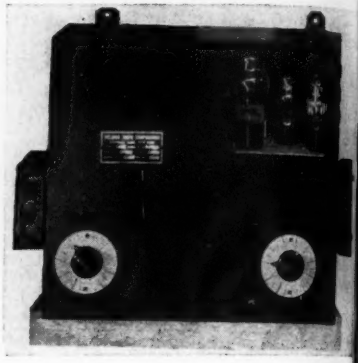
Safest to handle
Safest in operation
They wear *longer*
They cost *less*

For lasting belt joints modernize your lacing equipment -use Clipper

Clipper
Belt Lacer Company
Grand Rapids, Michigan

complished with Welco Timers, opens vast new field for spot welding. Alum inum, brass, copper, stainless steel, chr mium and nickel plated parts, and ma other materials may be successfull welded provided a correct combinatio of low welding time, pressure and pow is used.

Welco Timers are made in standar



150 Amp. Welco Welding Timer

sizes for 30, 50, 150, 250 and 600 a peres. This range covers practically a spot welding requirements, but larg sizes can be had on special order.

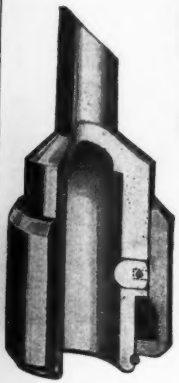
Norma Hoffmann Completely Enclosed, Cartridge-Type Precision Ball Bearing

The Norma-Hoffmann Bearings Co poration, Stamford, Conn., announc an addition to its extensive line of sel protected Precision Bearings, in th form of a completely enclosed cartrid type single-row unit designated as th "3000" Series.

The "3000" Series, although havi but one row of balls, has inner an outer rings of standard double-ro width. The bearing is completely en closed, and protected on both sides, b metal seals of special design held firm in place by snap-rings in the out race. These metal seals have a long in wardly projecting flange with a cl running fit over the grooved and m cessed inner ring. The latter arrang ment, while entirely free from rubbin friction and wear, forms an effective an permanent seal against the escape o lubricant. The metal sealing plates a easily removable for inspecting or clea

APEX
TRADEMARK

QUICK CHANGE DRILL CHUCKS



Sectional View

drive the collets by hardened ball nose plungers held in the body of the chuck by a cross pin. They are guaranteed *not to fall out* during the life of the chuck. Dirt cannot clog the plunger hole and interfere with the operation of the chuck. All tool changes made while spindle is revolving. No stopping of machine necessary. Drills, reamers, taps, counterbores and other tools may be used. Many operations performed without removing work from machine.

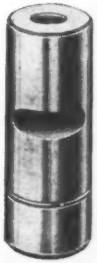
Driving Plunger

Apex chucks are furnished with Morse Taper shanks or with special shanks to suit conditions, or without shanks but with body tapped or bored to receive any spindle used. All parts hardened and ground. Made in six sizes.

Catalog with full information on request.

Morse Taper Collet

Also manufacturers of Safety Friction and Positive Drive Tapping Chucks, Vertical Float Tapping Chucks and Tap Collets, Full-Floating and Semi-Floating Tool Holders, Self-Releasing Stud Setters, Universal Joints, Universal Joint Socket Wrenches, Plain Socket Wrenches, and Screw Drivers, Apex S & H Adjustable Machine and Shell Reamers and Expansion Reamers.

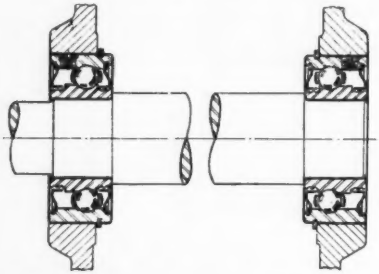


Free Floating Tap Collet

THE APEX MACHINE & TOOL CO.
THIRD AND MADISON STREETS, DAYTON, OHIO

ing the bearing. The bearing is handled as a complete, self-protected cartridge unit at all times.

The wide inner and outer rings give two great advantages. First, exceptionally large grease capacity is afforded, sufficient for long periods of continuous operation under average operating conditions. Second, looseness or "peening" of either shaft or housing is obviated by the greater contact area the wide rings provide. In most cases, lock nuts on the shaft are not required.



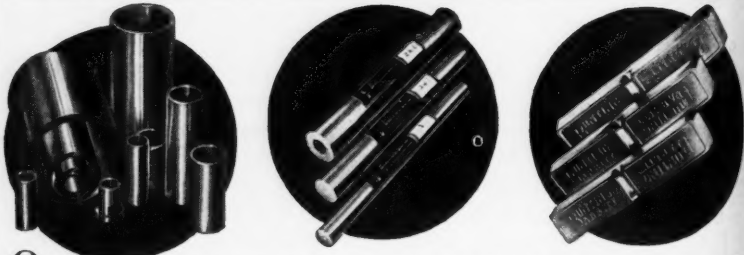
Drawing illustrating construction of Norma-Hoffmann "3000" Series Cartridge Type Precision Ball Bearing in cross section, also simplicity and compactness of a typical mounting.

The "3000" Series Bearing can be furnished either with or without a filling plug for renewal of grease. Where the filling plug is not employed, regreasing is effected by removing and replacing one seal. The new bearing can also be furnished with, or without, the snap ring on the outer race.

In many cases it is possible to reduce the overall length of the unit in which the "3000" Series Bearing is employed because of the elimination of sealing devices otherwise required. Supplementary protecting parts are usually obviated, also, and the assembly simplified accordingly. The "3000" Precision Bearing is made chiefly in the medium series starting at 25 m/m bore. The illustration shows the bearing construction in cross-section, as well as the simplicity and compactness of a typical mounting.

Atkins Hole Saw

A hole saw with which holes from ⅞ in. to 4⅛-in. diameter can be cut in flat metal sheets, pipe, formica, bakelite, wood, and other materials has been



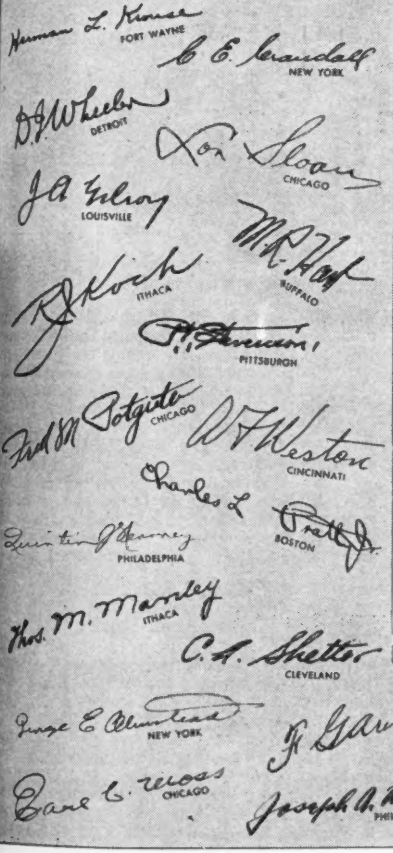
OVER 500 sizes of Bunting Bronze Standardized Bearings obtainable from stock—121 stock sizes of Bunting Machined and Centered Cored and Solid Bars—Bunting Babbitt, a really superior industrial anti-friction metal. Write for catalog or ask the Bunting Mill Supply Wholesaler.

THE BUNTING BRASS & BRONZE COMPANY
TOLEDO, OHIO
Branches and Warehouses in All Principal Cities

BUNTING Quality
BRONZE BUSHINGS • BEARINGS
MACHINED AND CENTERED BRONZE BARS
ANTI-FRICTION METAL

Thank You!

1935 A BIGGER AND BETTER YEAR



It's been a great year for Morse. Thousands of customers, both new and old, have given Morse a generous share of their business during 1935. Throughout industry there has been a definite upturn in business—plants are being modernized, definite savings are being made in production costs and Morse is endeavoring to meet these demands through careful, considerate service to industry.

Morse is also keeping pace with modernization with new equipment at both Ithaca and Detroit plants. These increased facilities assure Morse customers of better service in manufacturing and delivery.

Morse takes this opportunity to thank industry for making 1935 a bigger and better year, and also to show its appreciation of the sincere and earnest efforts of these Morse men in the field. With thorough knowledge and experience in transmission of power, they are always ready to serve industry with better methods of power transmission.

MORSE

Silent and Roller Chains and Sprockets
Flexible Couplings and Clutches

Morse Magic Silent Chain Drive Selector automatically selects the proper drive, checks and designs chain drives, saves time. Send for one. It's free.

Morse 1936 Calendars are now ready. Ask for your copy.

MORSE CHAIN CO., ITHACA, N. Y.
Division of Borg-Warner Corporation

FASTER GRINDING PRODUCTION

Coolant Filtration Keeps Grit Wheels Clean—Polish Quicker

A large nationally known manufacturer states "The use of the filter in the grinding of cast iron increased the capacity of the tested grinder 65.8% and decreased the number of wheel dressings required by 87.5%."

Stop the accumulation of dirty, gummy sludge on grit wheels — speed up grinding operations and improve finishes by keeping Coolant clean and free flowing. Fostoria Sorwal Filter installations have solved the problem of Coolant efficiency for many manufacturers.

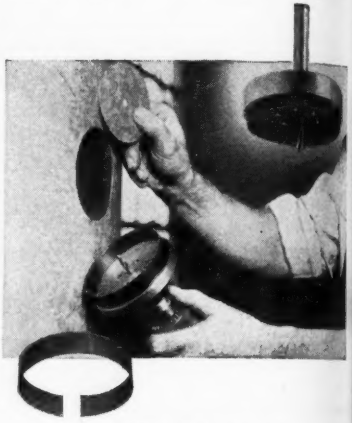
Test a Fostoria Sorwal Filter on one of your machines. See the results in lower grinding costs, better finishes, faster production. On request a test will be arranged without obligation.

THE FOSTORIA PRESSED STEEL CORP.
Industrial Div. • Fostoria, Ohio

SORWAL fostoria FILTER

placed on the market by E. C. Atkins and Company, 402 South Illinois St., Indianapolis, Ind. The outstanding feature of the saw is the fact that the blade is instantly replaceable in a permanent saw holder, eliminating the necessity of discarding the holder when the blade is worn out.

The spindle for the Atkins Hole Saw is available in two types; the No. 2 which is ½-in. in diameter and the No.



Atkins Hole Saw

3, which is ¼-in. in diameter. Both spindles fit any diameter of holders and blades. The holders are also made in two sizes; the No. 4, for use with a ½-in. center drill as a hole guide and the No. 5, which is intended for use with a drill jig. Both holders are fitted with clamp wedges and lock nuts for extracting cores.

The saw is equipped with Atkins alloy steel blades having 14 teeth to the inch. Atkins Silver Steel metal and wood cutting blades may also be used on these saws, depending on the material to be cut.

Kron Bench Scale

To meet the need for a small bench scale of sturdy design for use in production lines where materials must be weighed in process of assembly, The Kron Company, 1718 Fairfield Ave., Bridgeport, Conn., has brought out the Kron Junior Bench Scale shown in the illustration. This scale is intended especially for the weighing of pistons, connecting rods, and similar parts. The platform is 16½x18½ in. and the scale has capacity from 50 to 125 lbs.

A STRAIGHT-AHEAD RATCHET MOTION SPEEDS UP NUT TURNING

Repair and contract work, when time is a factor, can be speeded up as the wrench does not have to be removed from the nut at every turn.

Each head can turn two different-sized nuts—one size on each end. This cuts down the number of wrenches needed, and effects a saving in the cost of equipment.

A slight movement of the handle turns the nut, a big advantage in cramped spaces.

Socket form of head fits snugly over nut, preventing slippage and damage.

Send for Full Particulars

Greene, Tweed & Co.

Sole Manufacturers

109 DUANE ST. NEW YORK

We are headquarters for Solid or Inserted Tooth Cold Saws and Band Saw Blades for cutting metal. Consult free about metal cutting problems.

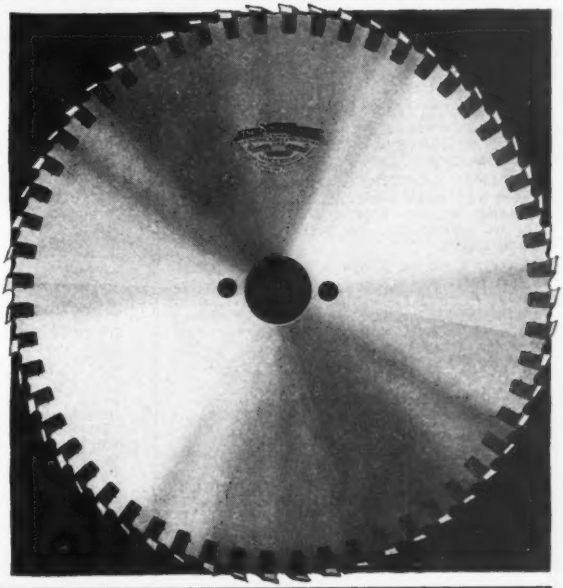
Write for new Metal Saw catalog.

SIMONDS

SAW AND STEEL CO.

FITCHBURG, MASS.

"The Metal Saw Makers"



WHAT ARE THE VARIOUS COATED ABRASIVES?

What Are Their Uses?

EMERY

By E. B. GALLAHER
Editor, Clover Business Service
Treasurer, Clover Mfg. Co.

OUR last ad described the various backings employed in Coated Abrasives—today we tell you about Emery.

● EMERY has been used as an abrasive material for thousands of years. It is a mined product — a natural abrasive — the best qualities coming from Turkey and the Greek islands. Emery deposits are also found in the United States, but the quality does not compare with Turkish Emery.

● EMERY is a natural Aluminous Oxide —it is relatively soft and dull when compared with the electric-furnace products. It also contains considerable foreign matter. Until the advent of electric-furnace Silicon Carbide and Aluminous Oxide, it was practically the only shop abrasive, and was used for all abrasive purposes.

● BEING SOFT, Emery cannot be economically employed for cutting hard metals. It will cut soft metals, however. The crystals, being dull, do not allow of its use for woodworking, where extreme sharpness is essential.

● A RELATIVELY SOFT, DULL CRYSTAL, however, is just the thing for polishing metals, and here is where Emery finds its greatest use.

● EMERY COATINGS are applied to both paper and cloth backings, though the large demand is for Emery Cloth in 9"x11" sheets, which may be found in all hardware stocks.

● THE COMMON ERROR is to call all Metal-Working Coated Abrasives "Emery Cloth." As a polishing medium, Emery Cloth is all right, but when a cutting cloth is desired, you should ask for Aluminous Oxide. In other words, you should know your Abrasives.

Gallaher

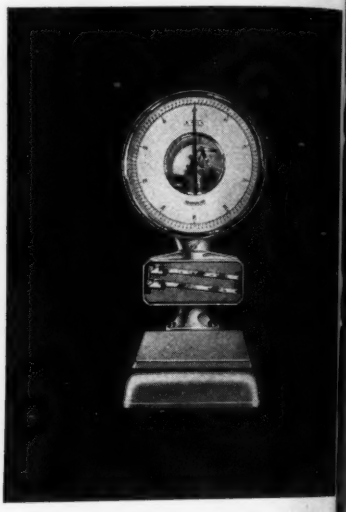
● File these ads for reference.

CLOVER MFG. CO., NORWALK, CONN.

Also Makers of the Famous
CLOVER GRINDING AND LAPPING COMPOUNDS

The dial mechanism on the Jun Scale is similar to the standard Kr double pendulum ball bearing type us in the larger scales, although smalle The mechanism is both simple an rugged in design and will maintain i accuracy over a long period of servi without adjustment.

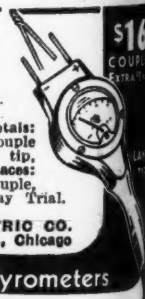
In the platform, the standard Kr full floating type of construction i utilized. The design is such that no



Kron Bench Scale

of the lateral motion of the platfo is transmitted to the lever system. I operation all the levers operate abo fixed fulcrums. Thus wear comes o the pivot and bearing only when a lo is actually being weighed, greatly i creasing the life of the scale.

EVERY SHOP needs these rugged, accurate, portable Pyrometers. L88 for checking **Surface Temperatures:** 800° range with 1 ft. silver tip couple, $17.90. L89 for **Non-ferrous Metals:** 1600° range with 2 ft. couple and 1 ft. replaceable tip, $19.30. L90 for **Furnaces:** 2500° range with 3 ft. couple, $19.00. Sent on 30-Day Trial. Circular Free.

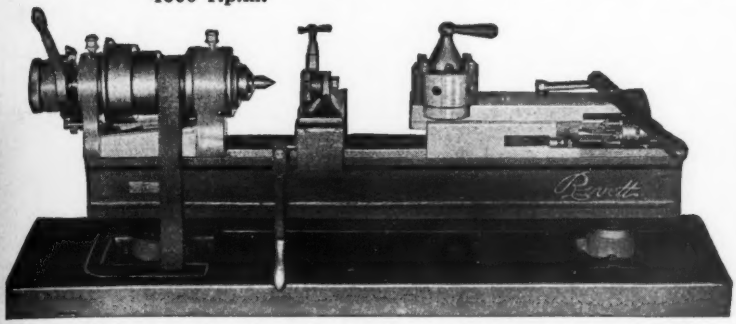


RUSSELL ELECTRIC CO.
338 W. Huron St., Chicago

Hold-Heet Pyrometers

RIVETT ANTI-FRICTION SPINDLE BENCH LATHES

are high production low cost machine tools for small bar or chuck work. 6, 12 or 18 selective speeds up to 4600 r.p.m.

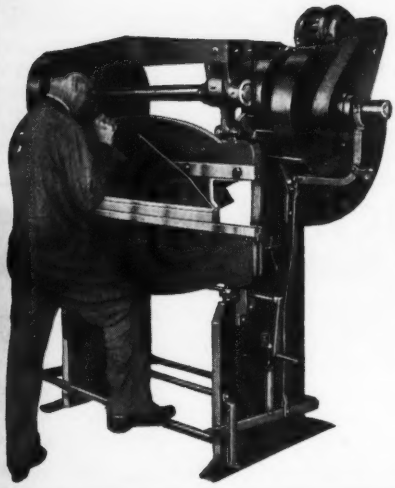


Built with Timken Zero Precision roller bearing or Preloaded ball bearing heads. Collet capacity up to 1" diameter. Swing 8". Roller bearing lever chuck closer. Automatic six station turret. Cutting off and forming slide. Speed box drive with automatic brake. Oil pan.

Write for Bulletin 505-RB and price list.

RIVETT LATHE & GRINDER, INC. BRIGHTON, BOSTON, MASS.

THIS No. 253 CHICAGO STEEL PRESS



Will Do 40% to 60% of the Forming Work Turned Out by the Average Shop

This compact, ruggedly built, 48", No. 14 gauge capacity, Chicago Steel Press brake is an economical and profitable production unit. It is ideally adapted for rapidly forming metal sections such as in stoves, refrigerators, soda fountains, steel cabinets, metal furniture, steel boxes and a great variety of sheet metal specialties. Variable speed drive operates from 17 to 50 strokes per minute. Precision built of highest quality materials by master craftsmen.

Write for Circular No. 253

DREIS & KRUMP MFG. COMPANY

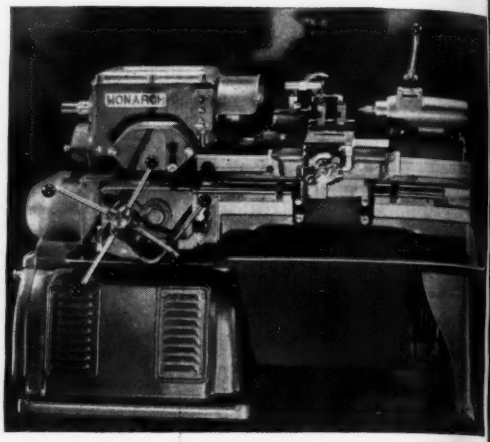
7418 LOOMIS BLVD.

CHICAGO ILLINOIS

Monarch 12-In. Type "T" Semi-Automatic Manufacturing Lathe

The lathe shown in the illustration is the Monarch 12-in. Type T Double Carriage Semi-Automatic Lathe which was exhibited at the Machine Tool Show by the Monarch Machine Tool Company, Sidney, Ohio.

This new semi-automatic manufacturing lathe is designed to handle the smaller classes of production jobs where a quick, convenient hand return to the tool slide is desirable. The lathe will accommodate the main drive motor up to 10 h.p. It is equipped with automatic length feed stop, and so arranged that a very quick tool set-up, for either single or multiple tool jobs, can be made. Extremely rigid in construction, this new lathe is equipped with anti-friction bearings throughout, and it is interesting to note that all the steel parts are heat treated and hardened. This new lathe will operate at spindle speeds as high as 2000 r.p.m. in order to take advantage of the new cemented carbide turning tools.



Monarch 12-Inch Type T Semi-Automatic Manufacturing Lathe

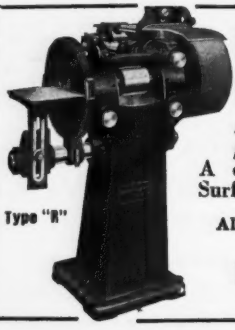
The lathe is very simple in design and can be furnished with special tooling to perform a wide variety of single or multiple tooled manufacturing operations. It can be equipped with front carriage or with both front carriage and rear facing carriage. The rear facing carriage can be applied to the lathe after shipment from the factory.

The motor, mounted inside the cabinet leg, drives by multiple V-belt. Convenient pick-off gears are provided to change spindle speeds and to change feeds on both the front and rear carriage.

Swing over bed ways is 12½ in. while the swing over the carriages is 7 in. Distance between centers can be 18 in. Base length, 30 in. and 42 in. Net weight of the 30-in. base length machine is 3400 pounds. Any desired range of spindle speeds or feeds can be provided.

Baker "Clean-Line" Hydraulic Drilling Machines

The machine illustrated is one of the line of "Clean-Line" Hydraulic Drilling, Reaming, Boring, and Forming Machines that have been developed by Baker Brothers, Inc., Toledo, Ohio. The fea-


Type "R"

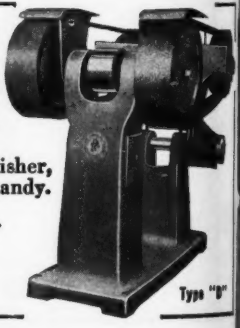
PRODUCTION
Polishing Machines

save time and money and improve your product.

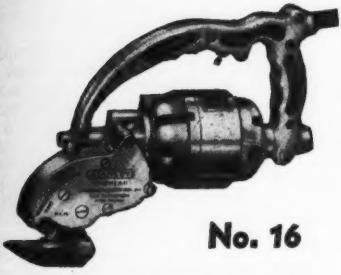
A combination Ball Bearing Polisher, Surfacer and Disc Grinder. Very handy.

Also Single or Double Wheel Polisher.
Other Types

Production Machine Co.
GREENFIELD, MASS.


Type "D"

NEW PORTABLE UNISHEAR



No. 16

CUTS UP TO 16 U. S. GAUGE (1/16") STEEL

A definite need has been expressed for this portable Unishear of intermediate capacity. It is ideal for use where the requirements are too severe for the "Mighty Midget" Unishear with its capacity of 18 U. S. Gauge Steel and not sufficiently heavy to justify the purchase of a No. 144 Unishear with its capacity of 14 U. S. Gauge.

Patterned after the "Mighty Midget," the No. 16 is surprisingly light in weight, sturdily built and easy to handle. It is 100% safe.

Cuts straight lines, angles, notches and curves to a minimum radius of 1½". Speed up to 15 feet per minute.

Because of its large reserve capacity the No. 16 Unishear can be operated continuously as a production tool without ill effects.

Descriptive literature gladly furnished

STANLEY

STANLEY ELECTRIC TOOL DIVISION
THE STANLEY WORKS
137 Elm St., New Britain, Conn.

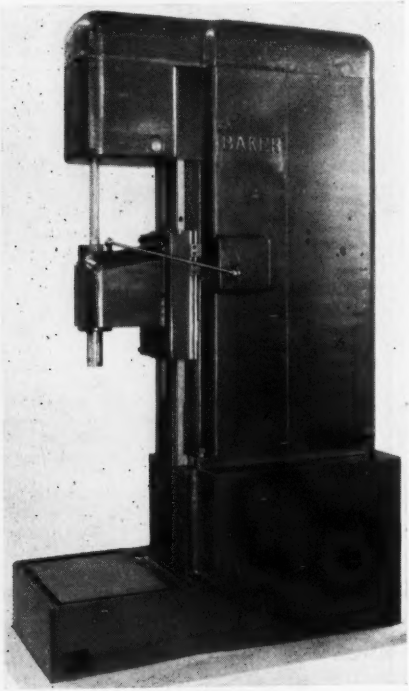
STANLEY UNISHEARS
MODELS AVAILABLE WITH CAPACITIES UP TO ¼" BOILER PLATE

MARKING MACHINERY

HI-DUTY MARKING MACHINES are built in standard designs for general marking, as well as special designs to perform specific jobs of marking. They are built in manual as well as power drives. Continuous service to metal fabricators in the country since 1895 has given us a world of experience, which may be of value to you. Send in prints or sample parts with lettering, locations, hourly production and lettering changes required. We will be glad to make recommendations without obligation to you.

GEO. T. SCHMIDT, Inc.
1806 BELLE PLAINE AVE.
CHICAGO, ILL.

ture of the machines is the "clean" exterior, all working parts being enclosed so as to afford the maximum protection



Baker 10-HO "Clean-Line" Hydraulic Drilling Machine

both to the machines and to the operators.

The machines are built in three sizes, indicated as the No. 10-HO, 20-HO, and 30-HO. The 10-HO machine, which is shown in the illustration, will have capacity of drilling up to 1¼-in. steel at the maximum speeds and feeds that the drill will stand in production work. The machine is powered by two motors: a 3, 5, or 7½ h.p. motor to drive the spindles and a 2 h.p. motor to drive the hydraulic pump.

The 20-HO machine will have capacity for drilling 2½ in. in solid steel and will also be powered by two motors. The machine main drive motor can be 5, 7½, or 10 h.p., with a 3 or 5 h.p. motor to drive the pump. The 10-HO machine has a No. 4 Morse taper in the spindle, and the taper on the 20-HO and 30-HO machines is a No. 5 Morse.

Power is transmitted from the main drive motor to the spindle through a Multi-V-belt drive across the top of the machine, to a gear box mounted on the upper face of the frame. The design of the gear box is such that the machine can be furnished as a single purpose machine with pick-off gears for changing speeds, or as a universal quick change type machine with four quick changes of speeds in combination with pick-off gears, providing a wide range of speeds.

On the quick change machine, the speed changes are secured through a sliding gear transmission. All gears in this box are of hardened alloy steel, the shafts are multiple splined, and all gears and bearings are automatically lubricated with a self-contained oiling pump mounted in the head box. The spindles are multi-splined at the top driving end and are mounted on selected ball bearings in the head housings mounted on the saddle of the machine.

The machine is equipped with the Baker pull-type hydraulic feed with the cylinders mounted on the base of the machine. An Oilgear pump is used, mounted in the base of the machine, to

Increase Your Machine Efficiency with

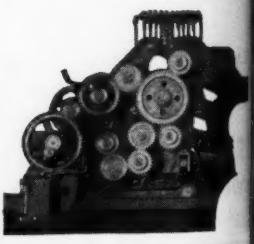
Automatic Lubrication

Blanchard Pulsolator Automatic Oil Lubrication Provides:

measured delivery of oil visible at each bearing when in motion.

increased production time and lowered oil and labor costs.

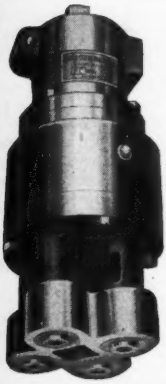
Write for descriptive bulletin B-10.



RIVETT LATHE & GRINDER, INC.

BRIGHTON BOSTON, MASS.

DEPENDABLE DRILL HEADS



When you apply United States Drill Heads to your drilling machines for multiple operations, you can always depend on them to do a good job.

Drill Heads designed to meet your individual requirements.

Send your blue prints for estimates

The United States Drill Head Co.
1954 Riverside Drive
CINCINNATI, OHIO

MENDES QUALITY DIAMONDS *Always Sharp*

"DIAMOND" POINT
ANGLE TOOL
for
WHEEL DRESSING

REDUCE GRINDING COSTS

FOLDER IN ON REQUEST

Mendes Cutting Factories, Inc.
DIAMONDS AND DIAMOND TOOLS
505 Fifth Avenue, New York, N. Y.
Rep.: Milwaukee, Indianapolis, Cincinnati, Pittsburgh, Baltimore

SHEPARD NILES CRANES

CAPACITIES:

1 TON TO 450 TONS

Overhead Traveling Crane Types: Floor or Cage Operated with single or twin hook, auxiliary hoist, extension, grab bucket, close clearance, or submerged trolley. Bulletins describing Shepard Niles Cranes and Hoists will be sent to you promptly on request.

SHEPARD NILES CRANE & HOIST CORP.
424 N. Schuyler Ave., Montour Falls, N. Y.

New Advanced GRINDERS By "DELTA"

A complete line of new grinders offering many new basic features never before found in machines of this type. In the new Delta Grinders new standards of accuracy, convenience and efficiency are attained. These are not just another line of grinders — but something radically better than anything ever offered.

The pedestal model is completely self-contained and portable. It carries its own lighting system, with tool tray, water pots, Twin-Lite Safety Shields. Available in two models for either light circuit or power circuit.

Wheels are balanced to within 1/100th of an ounce-inch. The new Twin-Lite safety shields offer perfect vision on each side and the face of the wheels, double seal ball-bearings are lubricated for life, accurate tool supports, adjustable spark guards, swinging water pots. Every feature has been considered to make these grinders the most efficient yet developed for all-around shop work. And best of all they are priced amazingly low. Available in three different styles—belt-driven, motor-driven and pedestal models, every one offering the same exacting specifications and the same exclusive features. Write for name of nearest Delta dealer and full details.

DELTA MFG. CO.
601 East Vienna Ave.
Milwaukee, Wis.

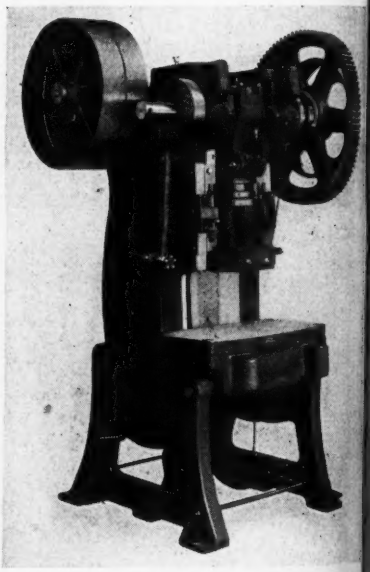
base also serving as a sump for the oil for the hydraulic system. All parts are enclosed, but easily accessible.

The 10-HO machine weighs 4,800 lbs. and requires floor space of 26x60 in. The machine is furnished standard with a box-type plain table, or can be supplied with a rotary index table. Provision is made for cutting lubricant with the sump in the machine-base.

The standard maximum spindle travel is 16 in., but the machine can be furnished for increased spindle travel if desired. The type of hydraulic pump used provides for fast rapid traverse speeds, the average rapid traverse speed on the 10-HO machine being 305 in. per minute.

Rockford No. 5½ R Inclinable Open Back Punch Press

Important improvements are incorporated in the design of the No. 5½R Inclinable Open Back Punch Press an-



Rockford No. 5½R Inclinable Open Back Punch Press

nounced by the Rockford Iron Works, Rockford, Illinois. A new locking device consisting of a split plug and drive bolt is used to lock the adjusting screw to the connecting rod. This does away

A New "D&W" Chuck

Style S-7 x 17

A sturdy, dependable chuck, 3 9/16" high to meet demand for lower chuck than our standard F-7 x 16.

List price (including Demag. switch) $65.00.

List price (without Demag. switch) $55.00.

●

J. & H. ELECTRIC CO.
202 Richmond St., Providence, R. I.

Anderson Improved Balancing Ways *No Leveling Required*

A simple and excellent device for balancing straightening and truing.

They are made in the following sizes:

Swing	Greatest Distance Between Standards	Capacity in lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000

Write for Full Information.

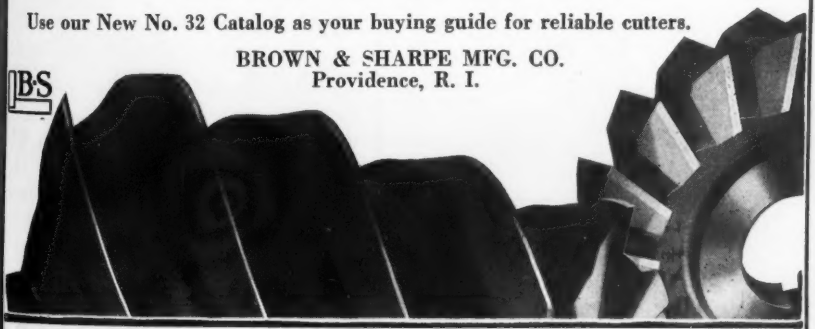
Mfd. By **Anderson Bros. Mfg. Co.**
1926 Kishwaukee St., Rockford, Ill.

With---new production standards demanding better tooling equipment

Buy---dependable **CUTTERS** that **FULLY** meet the new demands

Use our New No. 32 Catalog as your buying guide for reliable cutters.

BROWN & SHARPE MFG. CO.
Providence, R. I.



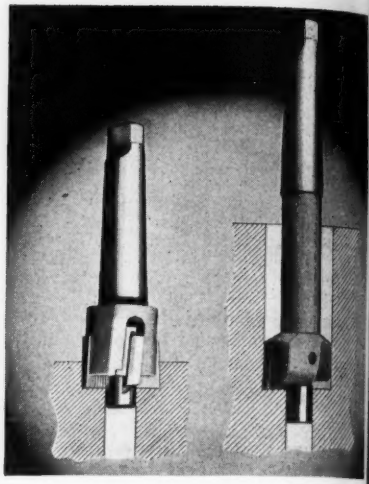
BROWN & SHARPE CUTTERS

with the old familiar saw slot which allowed the connecting rod to be squeezed on the adjusting screw and was the major cause of connecting rod breakage.

An alloy crankshaft is used, having both the brake collar and clutch collar forged all in one piece. The No. 5½R Press has a capacity of 56 tons. The Flywheel Press weighs 7,700 lbs., while the Single Geared Press weighs 8,950 lbs.

Ingersoll Zee Lock Counterbores

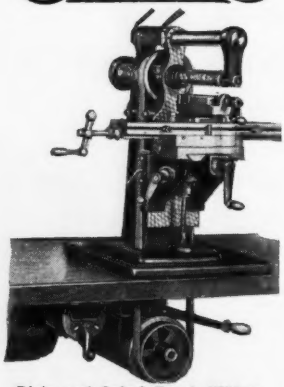
Inserted blade counterbores in which the Ingersoll Zee Lock Cutter Blades are used are now being made by The Ingersoll Milling Machine Company, Rockford, Ill. Two designs are offered; one of the shallow type used for shallow boring or spotfacing operations, and another for deep boring operations. Both incorporate the Ingersoll Zee Lock Cutter Blade which is positively locked and adjustable in two directions. Furthermore, the serrations are broached into the cutter housing so that by moving the cutter blade to the next slot in sequence, the blade is only moved out part of a serration. Thus, the diameter is maintained with the minimum of grinding.



Ingersoll Zee Lock Counterbores

The shallow counterbore has four serrated blades which interlock with a hardened and ground pilot; it is for boring where the depth of the counterbored

"Stark"



Plain and Spiral Bench Millers.
Most accurate of their type.
STARK TOOL CO.
EST. 1862 WALTHAM, MASS.
Originators of the American Bench Lathe

Sebastian Motor Drive Attachment For Cone Head Lathes

● For any make of lathe from 8" to 20" swing. Does not obscure vision. Easy to attach—low in price.

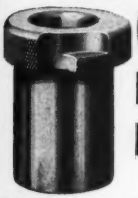
12" SIZE.....$55.00
16" SIZE..... 63.00
20" SIZE..... 90.00

The Sebastian Lathe Co.
CINCINNATI, O. U. S. A.

Sutton DIAMOND GRIP Collets

Diamond Serrations grip tighter under less pressure; last longer. Both solid and master-type collets furnished for all makes of machines. Send for Catalog No. 11 showing full line of Sutton screw machine accessories.

SUTTON TOOL COMPANY
2838 W. Grand Blvd., Detroit, Mich.



COLONIAL DRILL JIG BUSHINGS
A. S. A. STANDARD

You are sure of getting accurate and dependable drill jig bushings when you order COLONIAL. Made of High Grade Tool Steel. And when you order COLONIAL, you'll get them quickly.

Write for Specification Sheets and Prices

COLONIAL BUSHINGS, Inc.
145 JOS. CAMPAU ST.
DETROIT, MICH.

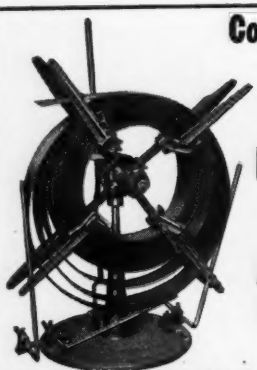
ADJUSTABLE While Running!

NEW Absolutely Different

THE PRECISION UNIVERSAL TOOL HEAD

ADJUSTABLE WHILE RUNNING! What a world of difference between this up-to-the-second, time-saving general purpose tool as compared with old-style offset or eccentric boring tools in which no essential change in the manner of adjustment has been made since the first one was exhibited at the Philadelphia Centennial in 1876—nearly sixty years ago! The Precision Universal Tool Head is a rugged, compact tool, accurately adjustable to fractions of a thousandth or fed continuously by a turn of the wrist WITHOUT STOPPING the tool or machine. All diameters from nothing to sixteen inches are instantly available not merely for boring but for facing, recessing, counterboring, undercutting, turning outside diameters, etc.—operations which cannot be performed in Milling Machine, Jig Borer, Horizontal Boring Mill or Radial Drill with any other tool. Send for bulletins showing difficult and unusual jobs done in unbelievably fast time with this truly Universal Tool Head.

THE PRECISION TOOL COMPANY
BRIDGEPORT, CONNECTICUT



Coiled Stock Can be Handled Most Efficiently with Littell Automatic Centering Reels

Littell Automatic Centering Reels enable one man to load and center heavy coils in less than two minutes regardless of the difference in inside diameters between one coil and the next. Centered coils turning on ball bearings revolve with the greatest of ease. This condition means greater production for both hand feeding and automatic feeding of coiled stock.

Write today for circular No. 5.

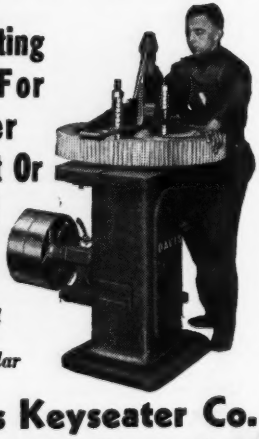
F. J. LITTELL MACHINE CO.

4127 Ravenswood Avenue, Chicago

Mfr's of Punch Press Feeds & Reels

A New Keyseater

With Tilting Table For Either Straight Or Tapered Bores



Send For Circular

Davis Keyseater Co.

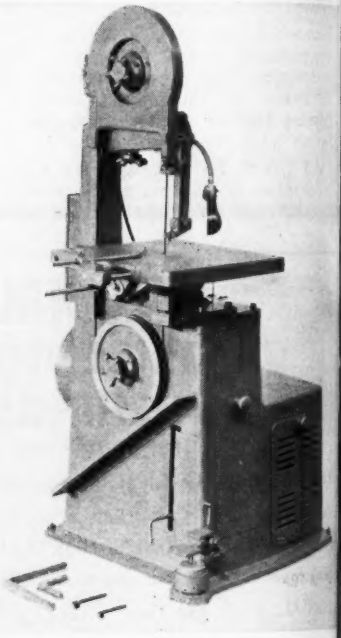
Exchange and Glasgow Sts.
Rochester, N. Y.

hole is less than one-half the diameter. The deep counterbore has two husky adjustable serrated blades. The body is well relieved for generous chip allowance, so that holes of great depth may be counterbored, or previously drilled holes enlarged.

The cutter bladés are of special selected high speed steel, fitted into a forged and heat treated alloy steel housing. The construction provides an economical tool, both as to initial cost, and as to replacement of cutter blades.

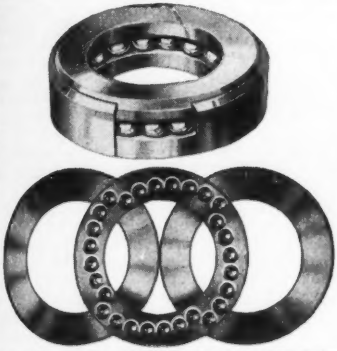
N-K-B Precision Band Saw

Neff Kohlbusch & Bissel, Inc., 2402 West Madison St., Chicago, Ill., have brought out the precision band saw with



N-K-B Precision Band Saw with Filing Attachment

filing attachment shown in the illustration. This machine consists of two major parts: a box column which houses the motor drive arrangement, a blower, feed weights, and so on, and the band saw unit comprising the work table, saw drums and drive members. The drive is taken by step cones through a worm



BALL THRUST BEARINGS

Special Bearings Made to Order. Any quantity.

"One Bearing or One Thousand"

Your present bearings duplicated. Send sketch or worn sample, regardless of condition, for quotation.

Catalog Upon Request

THE GWILLIAM CO.

358 Furman St., Brooklyn, N. Y.

there's a reason!

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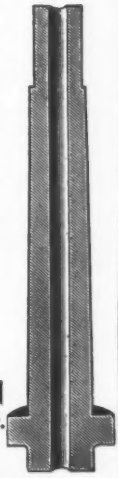

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Division of Star Electric Motor Co.

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and worm gear running in oil to the lower saw drum.

The saws, which range in width from ⅛ in. to ⅜ in., are cut in suitable lengths from standard coils and are joined by brazing. The upper saw drum is provided with 5-in. adjustment to permit the tensioning of the saw. The lengths of the saws vary from 9 ft. to 10 ft. Automatic feed is provided for the feed mechanism consisting of weights located in the column and attached to a wire cable which feeds the work to the saw by pulling a pressure pin against the work-holding frame. Both the operator and the machine are well protected by guards.

External sawing operations are handled in the usual manner. For internal sawing, however, the end of the band saw is inserted through a previously-drilled hole in the work and the ends of the band are then joined by brazing. The saw is then introduced through a slit in the machine table, placed on the drums and tensioned. Suitable guides support the saw above and below the work.

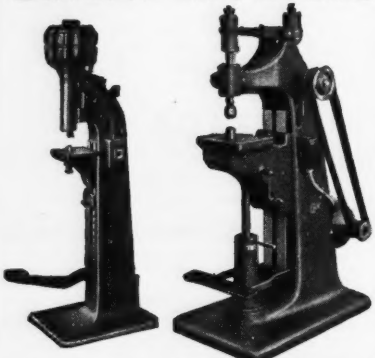
The size of the table is 22x22 in. and the dimension from the saw to the column is 14 in. The table can be tilted to an angle of 10 deg. in either of four directions. Maximum thickness of material admitted, 8 in. The band saw operates at a speed of 125 ft. per minute and saws operate at a speed of 180 ft. per minute. Power is supplied by a 1 h.p., 1800 r.p.m. motor. Net weight, 1700 lbs.

Standard equipment includes two work-holder frames of 5-in and 11-in size, one saw blade, one file chain of 22 links, two file chain pulleys, one file chain guide, one saw guide, one set of wrenches and one electric brazer. Included in the extra equipment is the filing fixture for filing down the braze, a thickness gage, extra saw guides for different sizes of saws, bench grinder for scarfing saw blades prior to brazing, and a lamp bracket.

Wells No. 18D Drill Sharpener

The illustration shows the Wells No. 18D Drill Sharpening Machine which has been placed on the market by Wells Manufacturing Co., Greenfield, Mass. In the design of this machine every factor involved in the construction of the drill —point angle, relief, web thinning, chisel-edge angle and corners—have been taken into consideration. The machine is said to be designed upon the principle of the hand motion used by the

GRANT RIVETERS



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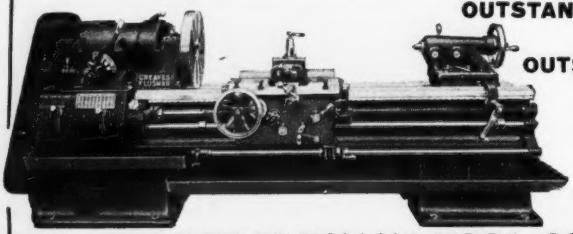

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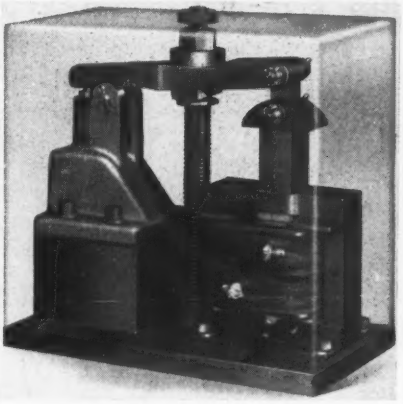

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experienced mechanic when sharpening a drill.

The manufacture claims that any shape of point desired can be produced with this sharpener and duplicated repeatedly without fail. All of the functions in the drill point may be varied or they may be set as required. The drill is sharpened by a full 360 deg. rotating motion which provides cutting edges of equal lengths, of the same angles with the center line of the drill, and with identical relief angles at the periphery on both lips increasing in angle to the center of the drill.

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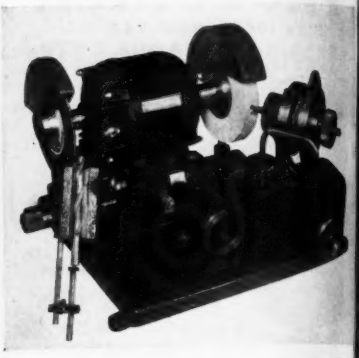
Full adjustment of angle of presentation to the grinding wheel, through a 90 deg. quadrant, makes it possible to sharpen the drill with any included point angle desired. The proper angle of



Wells No. 18D Drill Sharpener

relief is a matter upon which authorities differ, but it is agreed by all that the relief angle must increase toward the center of the drill. Any relief at the periphery required from 6 deg. to 1 deg. is instantly available. The web may also be thinned and the corners removed to any extent required by the user.

The sharpener is powered by a 1/3 h.p. 110 volt 60 cycle single phase 3400 r.p.m. motor and is provided with a cord and plug for connection to the lighting circuit. The machine has a capacity up to 1-in. drills and can be equipped for left-hand drills or for one, three, or four-lip right or left hand drills. The wheel is 7x1x1 in., straight, mounted on the right-hand motor extention for drill sharpening and a 7x3/32x1 in. straight wheel is mounted on the left-hand mo-

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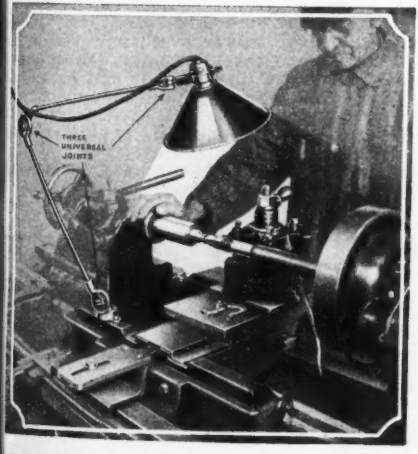

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tor extension for web thinning. The sharpener requires bench space approximately 15½ in. square and weighs 110 lbs. complete.

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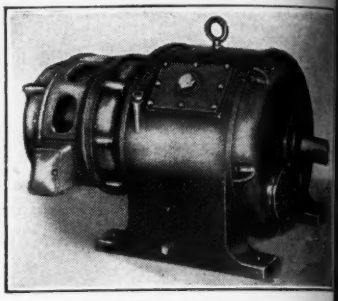
The Diehl Manufacturing Company, Elizabethport, N. J., has affected an arrangement with Foote Brothers Gear & Machine Co., Chicago, Ill., which enables the Diehl Company to present a complete line of quality gear motors and speed reducers for every type of speed reduction drive. The line includes helical as well as worm gear drives, eith direct connected or coupled type, single, double, and triple reductions horizontal, vertical or right angle dri The motors on the double and triple r duction units are supported on the ge case, which is ruggedly constructed handle the heavy torque loads of t



Diehl "IXL" Gear Motors

slow speed shafts, and the combinati is designed for heavy duty service.

Diehl "IXL" Helical Gear Motors particularly adapted to drives which quire ¾ to 75 h.p. and speeds down 6 r.p.m. on the slow speed shaft wh used with 1750 r.p.m. motors. Low speeds are available by using slow speed motors. These units are equipp with heat treated chrome nickel st gears. Oversize anti-friction bearin are used, properly spaced and propo tioned to handle overhanging loads fr gear or sprocket wheel drives on t slow speed shafts. The efficiency of t double reduction units is approximat 96 per cent, and the efficiensy of t triple reduction units is approximat 94 per cent.

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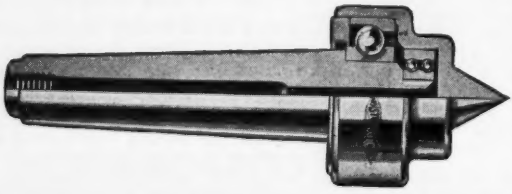

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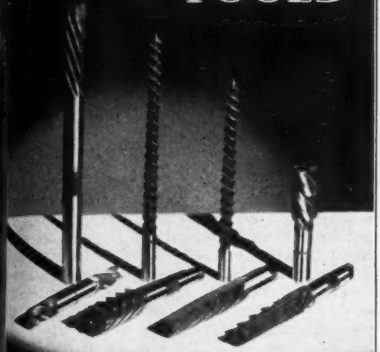

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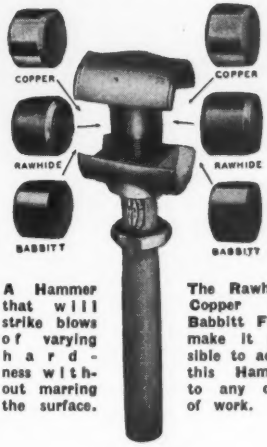

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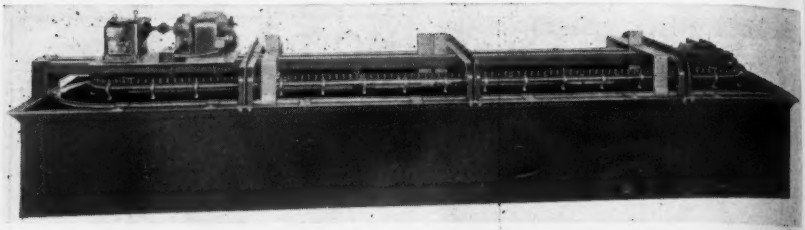


Side view of 18 ft. Udylite semi-automatic plating machine. Drive mechanism is mounted on common bed plate (left) to preserve proper alignment. At right is the loading end.

h.p. to 40 h.p. with speeds on the slow speed shaft down to 30 r.p.m. when equipped with 1750 r.p.m. motors. Lower speeds are obtainable by the use of slower speed motors. Worms are made of high carbon alloy steel carbonized, hardened, ground and polished. Worm gears are accurately hobbed with involute tooth forms from high grade chilled cast bronze.

Udylite Semi-Automatic Plating Machine

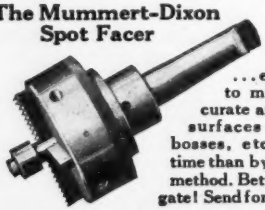
The Udylite Company, 1651 East Grand Blvd., Detroit, Michigan, announces the development of a new semi-automatic plating machine. This machine is said to offer the advantages of better plating results, closer production regulation and lower plating costs. Construction of the new unit includes a number of improvements in design which contribute to lower operating cost and a minimum of maintenance expense.

Better plating results and a marked reduction of rejects are effected because each piece being plated is subjected to identical plating conditions; i.e., plating time, current density, etc. Therefore, the machine can be set and work plated to the desired thickness specification is produced.

Production can be regulated within very close limits. The work racks are hung on the chain conveyor and are carried away from and brought to the operator at a definite rate of speed. This results in a continuous uninterrupted flow of production which in turn means a saving in labor. Any desired speed between 1 and 4 ft. per min. is obtainable.

In addition to money saving through reduction of rejects and closer production regulation, the Udylite Semi-Automatic effects still further savings in that one man can do the work of two or pos-

The Mummert-Dixon Spot Facer



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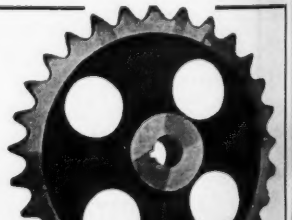

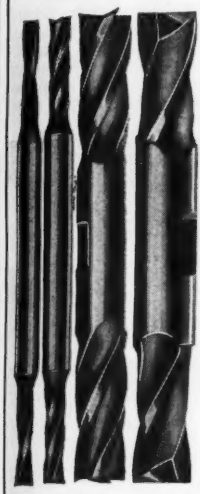

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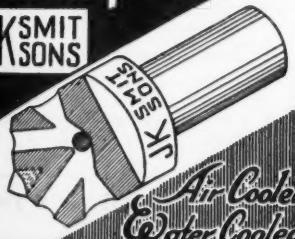

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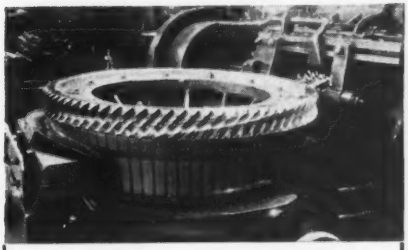

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"The Hack Saw People"
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sibly three with several still tanks.

In the construction of the Udylite Semi-automatic, attention has been paid to simplicity, compactness and durability. Design features include strong structural steel chassis, new, simplified chain-hook combination, alloy steel

Close-up of chain-cathode hook combination. Chain is directly engaged to hook and exerts direct pull which results in smooth operation.

chain with breaking strength exceeding 5 tons, and cut tooth drive sprockets. The machine is equipped throughout with ball and roller bearings which need lubrication but once every six months. Hooks are designed for heavy loads. The Udylite Semi-Automatic is made in a wide variety of sizes to conform to the individual plating problem.

Cleco Rotary Grinder

The illustrations show two types of rotary grinders which are now being built by The Cleveland Pneumatic Tool Co., 3736 East 78th St., Cleveland, Ohio.

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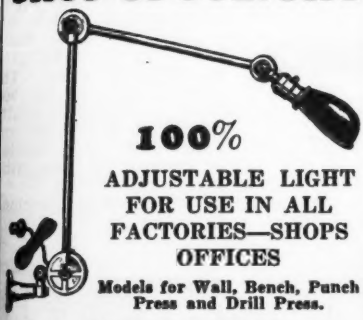

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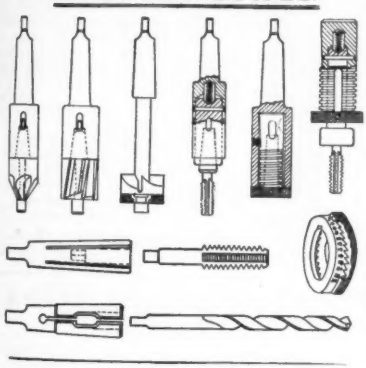

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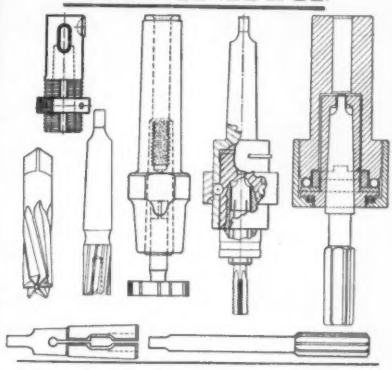


(Reproduction of cross section of Catalog No. 105)

A new 8½"x11" 144 page catalog containing detailed engineering information covering a complete line of production tools for drilling, tapping, reaming and counterboring.

WRITE FOR THIS CATALOG!

SCULLY-JONES AND COMPANY
1907 South Rockwell Street Chicago, Illinois

The grinders are made in two styles, as shown, one with a straight handle and the other with a spade handle, and are supplied to operate at three different speeds, using three different sizes of wheels for three different classes of work. The three sizes with straight handles are indicated as Nos. 860S, 845S and 830S. With spade handles, the numbers are 860 X, 845X and 830X.

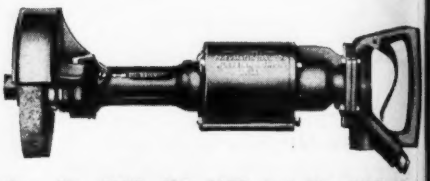
Cleco No. 860S, No. 845S and No. 830S Rotary Grinder with straight handle.

The No. 860 Grinder is built with a $\frac{5}{8}$-in. arbor for $\frac{1}{4}$-in. wheel. Arbor for a $1\frac{1}{2}$-in. wheel will be furnished when specified. This grinder is built to use a 6x1¼x⅝-in. elastic bond wheel or a 4x1¼x⅝-in. vitrified wheel to run at a speed of 5800 r.p.m. The weight is 17½ lbs.

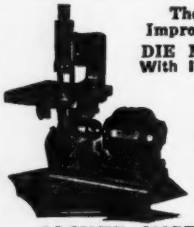
The No. 845 Grinder has a ⅝-in. arbor for 1¼-in. wheel and is built to take an 8x1¼x⅝-in. elastic bond wheel or 6x1¼x⅝-in. vitrified wheel. This grinder is equipped with a motor which operates at 4300 r.p.m. Weight 17½ lbs.

The No. 830 Grinder has a ⅝-in. arbor for 1¼-in. wheel and is built to take a 10 x 1¼ x ⅝-in. elastic bond wheel or 8x1¼x⅝-in. vitrified wheel. This motor operates at 3000 r.p.m. Weight 17½ lbs. Wheel guards of the correct size are standard equipment on these grinders, but the wheels are extra.

The grinders have been developed around the Cleco rotary motor, of which the essential parts are the four-blade



Cleco No. 860X, No. 845X and No. 830X Rotary Grinder with spade handle.



The Improved **OLIVER**
DIE MAKING MACHINE
With Its Many New Features

Will enable you to reduce the cost of labor on your dies, gages, cams, templates, stripper plates, experimental work, etc., from 30% to 60%. Send for our bulletin. No obligation.

OLIVER INSTRUMENT CO.
1430 E. Maumee Street, Adrian, Michigan

RIVETING?
LINLEY NOISELESS ROTARY RIVETING MACHINES

Assure Peak Production and Lower Maintenance. Rigid and Powerful. Bench and Floor Types. Motor or Belt Drive. There is a Linley machine for every riveting job.

Send Samples of your Work and we will furnish accurate estimate of production and quote cost of equipment.

LINLEY BROTHERS CO.
583 Fairfield Avenue
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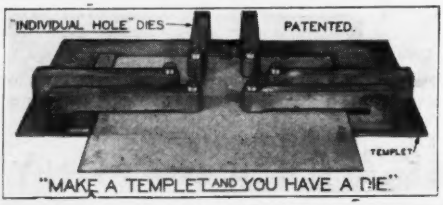
Wales Universal Perforating Dies
ARE "INDIVIDUAL HOLE" SUB-PRESS TYPE DIES



Perfect alignment of punch and die give longer runs and cleaner holes.
Once equipped, you can be in production the same day you first see the print of a part.
Write for detailed booklet.

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1559 Niagara St., Buffalo, N. Y.

LAPPED & POLISHED DIAMOND BORING and TURNING TOOLS

"V" Point

Offset

● For boring and turning all non-ferrous metals, bakelite, hard rubber, etc. Strong and keen cutting. Guaranteed to perform satisfactorily.

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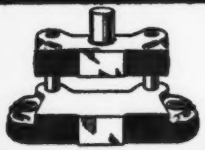
BAUMBACH



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SEMI-STEEL — DROP FORGED STEEL

Standardized Die Sets, embodying many exclusive features, and a listing of more than 95,000 stock sizes, afford a service that is unsurpassed.

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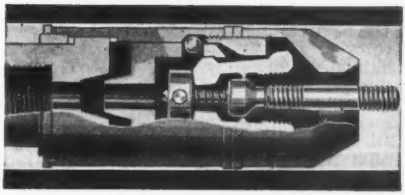


High Speed Stud Setting
The New Way

The Titan Stud Setter is a new self-opening type for driving stud bolts . . . it is full automatic in loading and releasing. It is a power driven unit adaptable to all types of drill presses and air or electric tools. Positive in driving and automatic in releasing, the studs may be set to any predetermined height desired and without straining or mutilating the threads.

The Titan Automatic Self-Opening Stud Setter provides most outstanding stud setting advantages. It will seat practically any type of stud and is adaptable to very successfully setting studs of extremely short lengths. It provides for increased production due to capacity, speed range and service . . . plus the added economy which its safety features assure by automatic operation. Write for new bulletin.

TITAN TOOLS

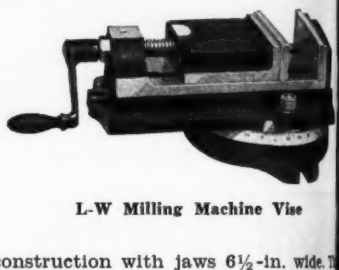
TITAN TOOL CO.
Fairview • Penn.

rotor, concentric with the arbor, and the renewable cylinder bushing. The rotor is of one-piece construction, machined from alloy steel, expertly heat treated and ground to size within close limits. The rotor is perfectly balanced, insuring smooth, vibrationless action at all speeds. This construction also permits the use of wide blades, giving long blade life and promoting efficient and economical motor action.

In all cases the rotor is powerful enough to insure immediate starting even under load. Ball bearings are used throughout and the double row bearing at the wheel end is so designed as to take end thrust in both directions. The rotor bearing is anchored to eliminate end play and prevent the rotor from rubbing the end blades. The speed of the grinder is controlled by a governor at all times, insuring ample power combined with economy of air consumption. A patented lubricating device insures lubrication of the rotor, its blades, and the throttle mechanism at all times. Two convenient oil filler holes provide means for lubrication of all bearings and the governor.

L-W Milling Machine Vise

The milling machine vise shown in the illustration has been placed on the market by the L-W Chuck Company, 20 N. St. Clair St., Toledo, Ohio. The vise is of semi-steel and is of flange



L-W Milling Machine Vise

construction with jaws 6½-in. wide. The jaws are 2 in. in depth and open to a maximum of 4¼ in. The vise proper swivels on a base that is graduated for 360 degs.; thus by loosening two nuts—one on each side of the base—the vise can be swung at any angle best adapted for the work in hand. The feed screw for the movable jaw is of steel, 1 in. in diameter, and is threaded through a bronze nut. The vise is well finished throughout and weighs 85 pounds.

EISLER SPOT WELDERS

½ to 100 K. V. A.

ELECTRIC SAW BRAZING MACHINES, BUTT, WIRE, PORTABLE AND SPECIAL WELDERS

Welders as low as $35.00

Submit Samples for Test. No Obligation.

Eisler Engineering Co.

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Unassigned Dealer Territories Available.

Write Chas. Eisler.

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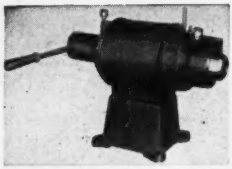

FOR LAPPING FINISHING POLISHING SMALL PARTS

2 Speed Motor. Automatic Brake. Collet or 3 Jaw Chucks. Hand operated or automatic. Write for Cir. 351.

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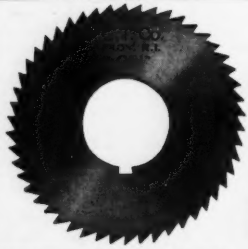

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HIGH SPEED SCREW SLOTTING SAWS

Circle "R" high speed screw slotting saws are made from the finest steels and are hardened and tempered correctly to give maximum service under the most severe usage. SPECIFY CIRCLE "R" SAWS.

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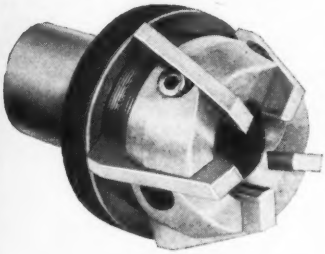
SEND FOR CATALOG *Branches: Detroit, Cleveland, Chicago, Muncie, Phila.*



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Are Cutting Costs Everywhere

SEVEN DIFFERENT STYLES

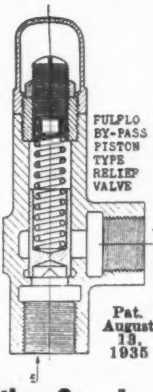
Have Genesee cut your costs. We design and manufacture hundreds of special and multiple operation production tools. Send samples or blueprints now. Write for catalogue.

GENESEE MFG. CO., Inc.

141 No. Water St., Rochester, N. Y.

FULFLO Non-Chattering By Pass Piston Type Relief Valve

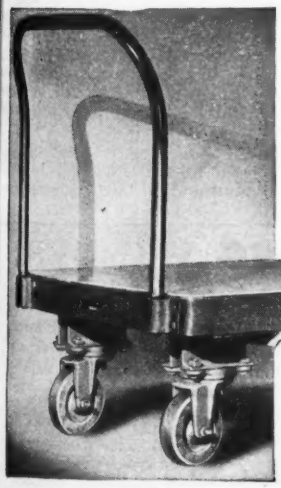
THIS valve is made in pipe sizes from ⅜ to 3" and is suitable for pressures from 10 lbs. to 1,000 lbs. Adjustment can be made by removing cap and turning adjustment screw at top of valve. The cylindrical piston seat closes off the port in a shearing manner, and does not seat abruptly against the body of the valve, thereby, relieving a pounding or chattering noise as ordinarily caused by standard valves using a disc seat.



Fulflo Specialties Co., Inc.

BLANCHESTER OHIO

Shop Truck Features LIGHT ACTION Under 2 Ton Loads



Here's a truck with stability and poise. Service Push E-Z has won top honors in many industries because it was built from the bearing surfaces outward—with heavy duty in mind all the way. Write for chart of sizes and capacities.

A few significant details: Timken tapered roller bearings. Chrome-steel ball bearings. Alemite lubrication. Hyatt roller wheel bearings. Jalcase steel axles. Electric welded 3-inch channel steel frame. All moving parts fitted to .002 of an inch.

SERVICE

CASTER & TRUCK CO.
596 N. Albion St.
Albion, Michigan

Ideal Tel-Temp

The illustration shows an instrument called the "Ideal Tel-Temp," which has been developed by the Ideal Commutator Dresser Co., Sycamore, Ill., to provide industry with an inexpensive, practical means of temperature control. The Tel-Temp is a convenient, sturdy thermometer which can be attached easily and quickly to the surface of a machine near the bearings or at any other point where high temperature may indicate trouble. The application of one of these instruments to a point of potential danger makes it possible to reduce maintenance costs by locating the tendency to over-heat and thus prevent burn-outs or mechanical failures. By using this instrument, also, it is possible to discover the lightly loaded motors and thus be able to give them more work to do without running into danger.

The mechanism of the Tel-Temp is simple; it provides an indicating register based upon the approved bi-metallic principle, enclosed in a dust-tight aluminum case. The cap is chromium plated and the crystal is non-breakable. The dial provides temperature readings from 0 deg. to 100 deg. Centigrade and the scale has a background of green, orange and red for indicating safe, caution and danger zones.

The outside diameter of the instrument is 2¼-in. and the height is 1⅝ in. The instrument proper screws into

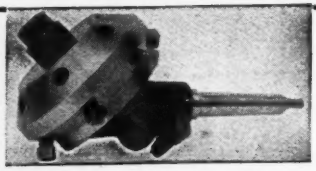
"Ideal Tel-Temp" Industrial Thermometer

THE SIGN OF GOOD GEARS

ALL TYPES . . . ALL MATERIALS

Good Gears . . . of any material . . . quickly and accurately made to any specification . . . that's what you can depend upon when you come to DIEFENDORF for your gear requirements. Quotations gladly furnished

DIEFENDORF GEAR CORPORATION
Syracuse, New York



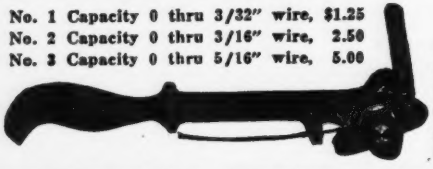
Lathe Turret Head . . . $30.00

Especially adapted to lathe work . . . holds 6 various ½" shank tools at one loading, thereby replacing drill chucks. Saves its cost quickly. Write for descriptive circular.

TOM'S MACHINE COMPANY
410 Niagara St., Niagara Falls, N. Y.

HERE'S A REAL SPRING WINDER!

No. 1 Capacity 0 thru 3/32" wire, $1.25
No. 2 Capacity 0 thru 3/16" wire, 2.50
No. 3 Capacity 0 thru 5/16" wire, 5.00



Will Earn Its Cost in one Day

The HJORTH Perfection Spring Winder offers the ideal means of winding extension, compression, torsion, taper, double taper, or left hand springs. Try one in your shop. You'll like it and the price is reasonable.

HJORTH LATHE & TOOL CO. 12 BEACON STREET WOBURN, MASS.

Greenerd Arbor Presses

Write for our Catalog 36 showing 64 different styles

Greenerd Arbor Presses
NASHUA, N. H.

SpeedWay Portable GRINDERS

Does a Hundred Jobs Well

Priced low, still built to industrial standards. 123 Grinder is a lighter, (all aluminum) handier, hand or lathe tool. Universal Motors take grinding wheels to 1¼". In case with collet, wrench and three wheels.

More Tool for the Money

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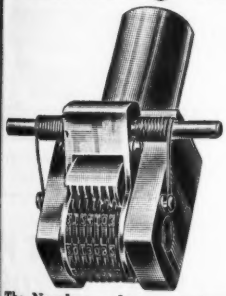
Numberall Automatic Numbering Machines



Of unfailing precision to give perfectly aligned impressions

The Numbers advance automatically. Used for consecutively stamping numbers or letters on metal and other material. Used in a punch press. Made with three to ten wheels. All size figures.

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Numberall Stamp & Tool Company

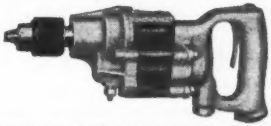
HUGUENOT PARK Staten Island, N. Y.

Tools that "pack a punch"

ROTOR AIR

Drills
Reamers
Nut Runners
Screw Drivers

for assembly and production work.



These tools are built around the simple Rotor motor which gives long dependable service—no pistons, cranks, connecting rods or commutators to get out of order.

Send for bulletin.

The Rotor Air Tool Co.

5600 Carnegie Ave. Cleveland, O.

European representative
GASTON E. MARBAIX, LTD.
Vincent House, London

a threaded stud on an aluminum base, the base first being attached to the machine frame by means of escutcheon pins. The instrument is applicable for use on water-jacketed machines, electric motors, generators, pumps, air compressors, bus-bars, bearings, and other similar mechanical units.

B & S Stainless Caliper Rule No. 391A

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently announced the

B & S Stainless Caliper Rule No. 391A

inclusion in its line of a new Caliper Rule No. 391A. Made of stainless steel, the stainless feature providing a lasting fine finish and clean, easily read graduations.

The rule is made only in 3-in. length and graduated with 1st corner in 8ths; 2nd corner in 16ths; 3rd corner in 32nds; 4th corner in 64ths; and the slide in 32nds and 64ths of an inch.

Cataract MD5 Precision Milling Machine

A precision milling machine especially designed for tool room and laboratory use has been brought out by Hardinge Brothers, Inc., Elmira, N. Y. The machine, known as the No. MD5, is built along modern lines, ruggedness being combined with extreme accuracy and ease of operation.

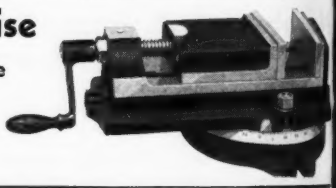
The headstock is enclosed with connected bearings and is equipped with a ball thrust draw spindle built for adapting 1-in. capacity collets. The knee section is fully enclosed around vertical feed screw bevel gears to exclude dirt and chips. A precision ball bearing absorbs thrust on the vertical feed screw. The knee and saddle are equipped with positive locks and adjustable stops. The table has a working surface of 20x8 in. and is provided with three T-slots, ⅞ in. wide, for bolting attachments and fixtures. Oil pockets and channels are provided in the table.

The working range of the machine

L-W Milling Machine Vise

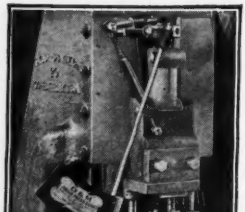
$29.50 Most outstanding value on the market.

85 lb. Semi-Steel flanged construction.
6½" Jaws—Hardened and Ground.
2" Depth of Jaws. 4¼" Opening of Jaws.
1" Steel Screw and Bronze Nut.



DIVIDING HEADS MAGNETIC CHUCKS MILLING MACHINE VISE

L-W CHUCK CO. • 20 N. ST. CLAIR ST. TOLEDO, OHIO



MORE SAFETY WITH THESE RELIABLE GUARDS

No matter how careful your punch press operators are, it pays to install D. & M. Automatic Guards. They provide more safety with positive, flexible and simple action. Inexpensive. Easy to install and trouble free.

Install one for 30 days at our expense. It will satisfy you or there is no obligation. Give name, size and stroke of press.

TAYLOR -- SHANTZ CO.
480 ST. PAUL STREET ROCHESTER, N.

THE NEW SHELDON 11" LATHE

• 11¼ in. Swing . . . Two bed lengths . . . 24 and 36 in. center distances . . . 1 1/16 in. Spindle Hole.

Semi-quick change gear box with gears for cutting 4 to 80 threads per inch.

Ask for Bulletin No. 23.

Sheldon Machine Co.

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CHICAGO, ILLINOIS

1905 Strand 1936

FLEXIBLE SHAFTS

and

MACHINES OF HIGH QUALITY

for

Grinding — Polishing — Buffing — Reaming — Wire Brushing — Drilling — Rotary Filing — Nut Setting — Screw Driving — and many other operations.

Vertical and Horizontal types

⅛ to 2 H. P.

Many Attachments.

Send for General Catalog.

Manufactured by

N. A. STRAND & CO.

5001 NO. LINCOLN ST., CHICAGO

Keeping the Count

On Production Machinery

Punch Presses Milling Machines
Drill Presses Screw Machines

Productimeter Counters give an accurate, automatic count.

Productimeters will also count objects on conveyors, or run through hoppers, and record strokes of engines, pumps, compressors and stokers.

The standard models include Stroke and Revolution Counters, Wire and Cord Measuring Machines, and Predetermined Counters for stopping machines at a preset count.

Send for catalog or tell us what you want to count.

Productimeters

THE SPEEDOMETERS OF INDUSTRY

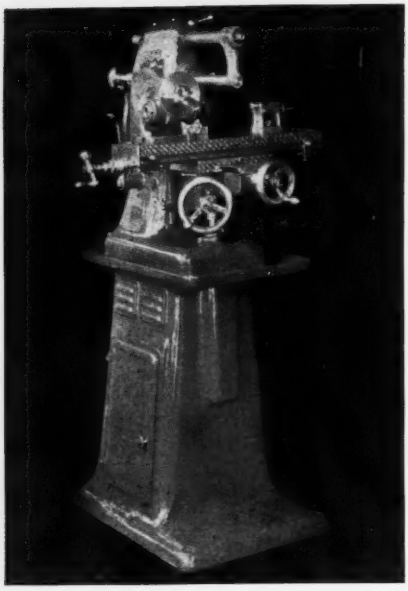
DURANT MFG. CO.

1932 N. Buffum St. Milwaukee, Wis.

173 Eddy St. Providence, R. I.

13¾ in. longitudinal, 6 in. transverse, and 7 in. vertical. The distance from the center of the spindle to the table in lowest position is 7 in. The overhanging arm is of solid steel and the distance from center of the spindle to underside of arm is 4 in.

Spindle speeds are high, including six speeds forward and six speeds reverse, from 120 to 1190 r.p.m. The spindle is

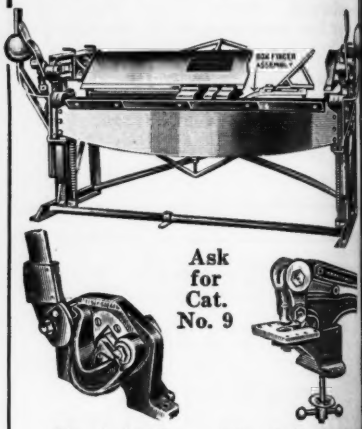


Cataract MD5 Precision Milling Machine

of the best grade ball bearing steel, hardened and ground, designed for adapting standard 5C Hardinge collets of 1-in. capacity. The arbor is ⅞ in. diameter and 7 in. long with spac and nut.

The machine is powered by a standa two-speed ¾ h.p. constant torque r versible motor, which is fully enclos in the base of the machine. An endl V-belt transmits power from the mot to the three step pulley. Floor space r quired, 45x43 in. Weight, 825 l Standard equipment includes the ful enclosed drive, index head, tailsto swivel vise, overarm support, ball thru draw spindle, arbor, and wrenches. A ditional attachments for a variety operations are available.

WHITNEY-JENSEN BRAKE



Ask for Cat. No. 9

No. 4 Angle Iron Shear

No. 8 Imperial Punch

WHITNEY METAL TOOL Co.
91 FORBES ST. ROCKFORD, ILL.

NEW PALMGREN ANGLE VISE
—AT ANY ANGLE—
—ACCURATELY GRADUATED—
(With Hardened and Ground Jaws.....$9.00)
HEAVY DUTY SIZES UP TO 8"

ONLY $7.50
No. 0
WIDTHS 2½"
OPENS 3"
DEPTH 1 7/16"
LENGTH 5"
WEIGHT 10 Lbs.

Write for Literature.

Chicago Tool & Engineering Co.
8400 SOUTH CHICAGO AVE., CHICAGO, ILL.

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PUMPS

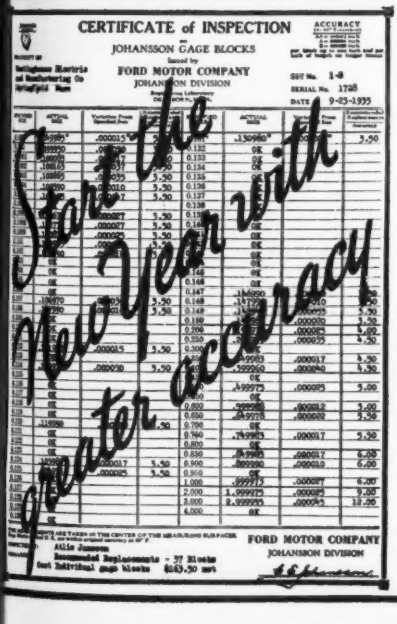
Write for new Engineering Data Sheet giving full specifications of these non-clogging, self-priming coolant and lubricant pumps—reversing and non-reversing types.

PIONEER
ENGINEERING & MFG. CO.
31 Melbourne, Detroit, Michigan
Also Centrifugal and Hydraulic Pumps.

Oiled Air is better than a poor memory for Air Tools!

A Norgren Sight Feed Automatic Air Line Lubricator feeds oil to the tool **with the air that drives it.** Constant, automatic lubrication. Adjustable from zero to complete saturation of air stream. Shipped on trial to any rated concern. Write for specifications and prices.

C. A. NORGREN CO., INC.
2018 Market St., Denver, Colorado


CERTIFICATE of INSPECTION
JOHANSSON GAGE BLOCKS
Issued by
FORD MOTOR COMPANY
JOHANSSON DIVISION
ACCURACY
SET No. 1-8
SERIAL No. 1738
DATE 9-23-1935
FORD MOTOR COMPANY
JOHANSSON DIVISION

Start the New Year with greater accuracy

HAVE YOUR JOHANSSON GAGE BLOCKS INSPECTED NOW . . . INSURE HIGH STANDARDS OF PRECISION IN 1936

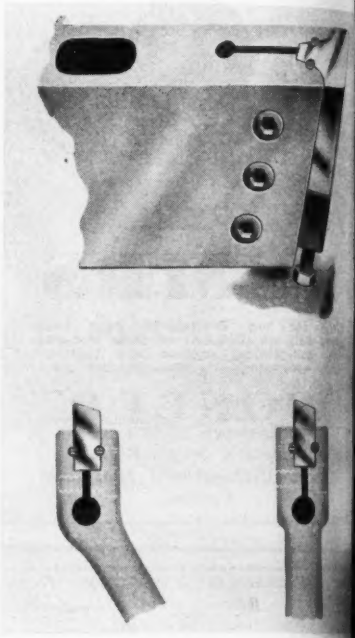
This is the Certificate of Inspection you will receive. It shows the accuracy of each block with the wear indicated in millionths of an inch. The cost for this service is very nominal—only 20 cents for blocks 1 inch long, and for longer blocks 20 cents per inch of length.

JOHANSSON
GAGE BLOCKS and ACCESSORIES
Manufactured, sold and serviced by
FORD MOTOR COMPANY
Johansson Division
Dearborn, Michigan

"Mitco Pin Splice" Turning Tools

A line of turning tools to be marketed under the name "Mitco Pin Splice" tools is being announced by the Michigan Tool Company, 7175 McNichols Road, Detroit. The basic feature of these new tools is a new and novel method of locating them in the tool holder. The mounting method used makes possible the designing of tools for longer useful life, elimination of breakage, simplification of regrinding and set-up, and for reducing production costs. It also makes possible the combination in a single tool of cutters formerly requiring a number of separate tools.

The Mitco Pin Splice method of hold



"Mitco Pin Splice" Forming Tool, showing method of clamping and the manner in which filler blocks are used to replace portions of the tool worn out in service. (Below)—Pin Splice tools can be used in even the simplest forms of lathe tool holders; here tools are shown for both straight and offset mounting for turning operations.

ing the tools combines the advantages

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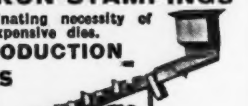

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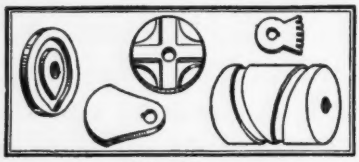

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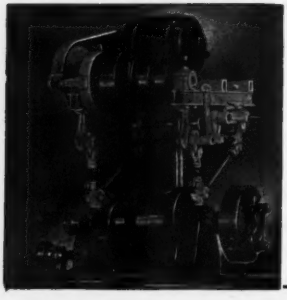

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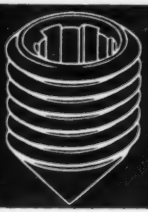

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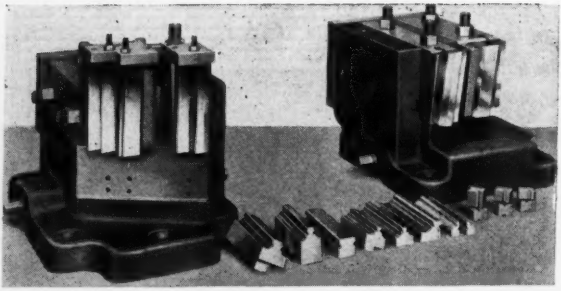


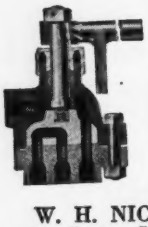
Complete pin splice tooling set-up for an automatic lathe for rough and finish turning, cheeking and forming of a rear crankshaft bearing, together with the crankshaft flange. The tool block at the left goes on the back side of the lathe. At the right, foreground, are shown filler blocks for use when tools have been worn down.

of the well known dove-tail and dowel methods and eliminates their disadvantages, guide pins being used to locate the tool in the holder. The holder and the tool are provided with small diameter semi-cylindrical grooves which are parallel to a line tangent to the work piece at the point of tool contact. Dowel or splice pins fit into these grooves and are fixed in the holder, so that the tool can be shifted up and down i the holder to the corre position, using the pi as guides. When in th correct position, the to is locked in place b tightening the clamps the split holder.

It will be evident th re-grinding is great simplified, in that th tool is merely grou "down" to a new cuttin edge, and shifted u slightly in the holde No angular adjustmen is necessary. With th arrangement, the too can be re-ground an made useable again an the process repeated un til the tool is complete used up, due to the elim ination of difficulties of properly clamp ing the tool when ground short.

The fact that these tools do no change their form throughout their lif makes it possible frequently to replac several bar stock tools with a single Pi Splice tool.

It may be noted also that for circul form turning, the new tools provide ad quate support under the cutting edge.



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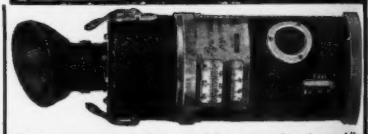

Unique construction enables operator to rapidly determine temperature even on minute spots, fast moving objects or the smallest streams; no correction charts, no accessories, no upkeep.
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Toolholders,
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Shop Furniture,
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The Western Tool & Mfg. Co., Springfield, Ohio

Link-Belt Self-Aligning Roller Bearing Unit

Link-Belt Company, 300 W. Pershing Rd., Chicago, Ill., announces a new line of bearing units which are to be known as Link-Belt Shafer Self-Aligning Roller Bearing "Series 400" and that stocks of these bearings, in the popular standard sizes, are now available. Shafer self-aligning double-row roller bearings are

Link-Belt Self-Aligning Roller Bearing Series 400 Unit

used in Link-Belt mountings, thus providing an excellent combination for general service. These units are available for pillow blocks, flange bearings, hangers, and take-ups.

The advantages of the new combination are pointed out as: (1) ability to carry (a) radial loads, (b) thrust loads, and (c) radial and thrust loads combined; (2) inherent self-alignment.

The self-aligning feature of the Shafer roller bearings is provided by concave rollers between convex outer races and a spherical inner race on the sleeve which is free to deflect with a shaft temporarily misaligned or out of line

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In stock for immediate delivery—gears, speed reducers, sprockets, pulleys, flexible couplings, racks, etc.

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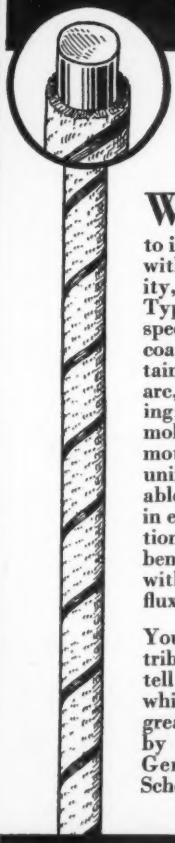


WHEN you're welding mild steel, and want to increase welding speeds without sacrificing quality, it will pay you to use Type W-20, because the specially woven heavy flux coating (1) aids in maintaining and stabilizing the arc, thus facilitating welding; (2) scavenges the molten metal and promotes a fast, smooth, and uniform flow; and (3) enables the operator to weld in extremely difficult locations, for the rod can be bent into various shapes without danger that the flux will chip off.

Your G-E welding distributor will be glad to tell you of many cases in which manufacturers have greatly speeded welding by changing to W-20. General Electric, Co., Schenectady, N. Y.

150-48

GENERAL ELECTRIC

because of inaccuracies of installation. The rollers travel in a true path on accurate races. Bearings are protected by labyrinth seals. Bores are ground for direct shaft application. Dimensions, radial load capacities, list prices and other data on these roller bearings are given in book No. 1494, which will be sent upon request.

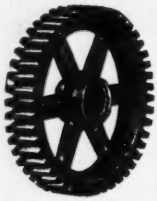
Cromodizing Rustproofing Process

Excellent rustproofing at low cost is claimed for "Cromodizing," a process developed by the American Chemical Paint Company, Ambler, Pa. By preventing rust from forming beneath paint films, this treatment is said to solve the problem of keeping steel units in serviceable condition. Cromodizing is adapted to protecting any type of steel surface regardless of size, shape or previous processing. Because of the low cost of the process, cromodizing makes available to a wide field of steel products the benefits of a lasting finish.

Prominent automobile manufacturers now using this treatment have shown in tests that cromodizing will at least triple the life of the finish on steel units. These manufacturers also report that paint has a better luster when applied over cromodized steel.

Cromodizing goes to the primary causes of rust and changes the steel so that the surface currents that induce rusting are stopped. To obtain this unusual type of protection, steel products are dipped in a bath or sprayed with a solution of a proprietary chemical called Cromodine. Only one minute is required for this Cromodine treatment. As with any other rustproofing process, the metal is first cleaned and following the chemical treatment is rinsed and dried. Generally speaking, cromodizing has been made clean-cut and foolproof so that it gives consistent results when supervised by production employees. Large units now in operation are showing an ease of control and a consistency of rustproofing heretofore unknown to the industry.

By changing the surface instead of coating it, cromodizing has the added advantage of forming a protection that is as flexible and as ductile as the steel itself—a protection that will not break and cause paint failure when the product is bent or distorted. Cromodized steel automobile parts in tests have shown great resistence to the corrosive action of salt used in the winter to remove ice from roads, as well as strong protection against the action of chemi-



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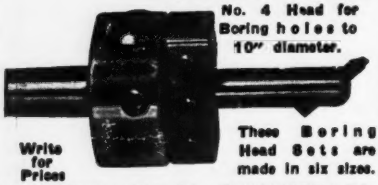

No. 4 Head for Boring holes to 10" diameter.

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These Boring Head Sets are made in six sizes.

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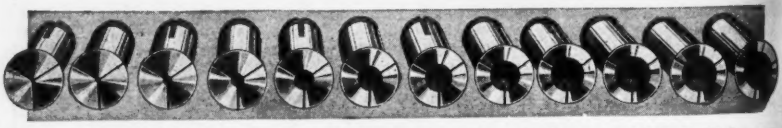
RIVETT DRAW-IN COLLETS AND CHUCKS



All lines of "Rivett Mark" Collets including Hendey, Cataract, Seneca and Rivett Styles can now be purchased from the following stocks:

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Write for Bulletin 100-A and Price List

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AND

NITRIDED CENTER POINTS

cals used to "lay" dust in summer.

Paint applied over Cromodized steel has an excellent luster, because there is no rough coating to absorb paint irregularly. Cromodized steel, too, has the effect of oxidizing the lower part of the finish film, forming in effect a cement that firmly binds the paint to the metal.

Jessop Steel Company Producing New Type High Speed Steel

The Jessop Steel Co., Washington, Pa., has announced that, under a license agreement with the Cleveland Twist Drill Co., Cleveland, holder of patent covering Mo-Max type of molybdenum high-speed steel, it is producing the same type of steel under the trade name of Mogul. This steel entails the use of only a small quantity of tungsten and of relatively high amounts of molybdenum. R. Edson Emery, president of the Jessop company, in making the announcement pointed out that of vital importance to American industry is the location in the United States of the largest known deposits of molybden from which ferro-molybdenum is m In the event of war between other tions, the United States would not dependent upon the import of this terial, as is the case with tungsten, production of molybdenum high-s steel would not be interrupted for of raw materials. Moreover, the a amount of tungsten contained in steel can be supplied by Ameri mines.

"Logan" Engineered Devices Production. This book, issued by Logansport Machine Co., Logansport, diana, comprises a 32-page catalog m up of 32 loosé leaves describing and lustrating the pneumatic and hydra presses, air cushions, chucking devi indexing fixtures, assembly machi various types of presses, and other equ ment made by this firm. The adva that have been made in recent y toward the adaptation of air oper and hydraulic mechanism for perform all sorts of operations that previou had been performed by hand will m

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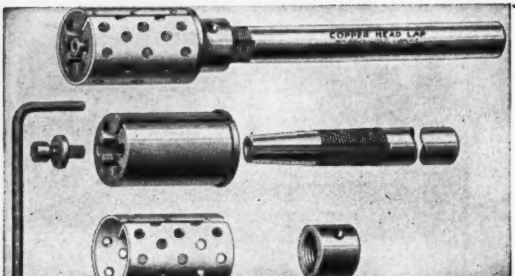

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THE WELDON TOOL CO., 321 Frankfort Ave. Cleveland, Ohio

this catalog of special value to the production plant executive or engineer. A copy will be sent to any mechanical engineer or executive upon request.

"HYGRADE" WORM REDUCER AND "MODERNTYPE" WORM GEARING CATALOG NO. 350. This book, now being issued by Foote Bros. Gear and Machine Co., 5301 S. Western Blvd., Chicago, Ill., has been issued in handy pocket size and contains 128 pages devoted entirely to the history and development of worm gearing. The catalog is divided into three sections as follows:

Section 1, devoted to the history and development of worm gearing and the worm reducer to its present state of efficiency. The problem of design, materials, manufacture, efficiency and selection are all thoroughly covered.

Section 2, for the convenience of the design engineer who wishes to lay out a worm and worm gear as an integral part of design.

Section 3, a complete list of standard hobs.

It is said that the supply of these books is limited and any executive who wishes one should reserve a copy by sending a request at once.

BALL BEARINGS. A comprehensive discussion of the bearing problems of machine spindles, and of the types of extra-precision ball bearings required in such applications, has just been prepared by the Fafnir Bearing Company, New Britain, Conn. The new bulletin, "Super-Precision Ball Bearings for Spindles" describes in particular the specifications and methods of applica-

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tion of the pre-loaded type of bearing required to eliminate shaft or spindle displacement under load.

A review of the development of the pre-loaded duplex bearings, and of the various types and arrangements now available, is a feature of the publication. Sectional drawings of typical types of machine spindles show the bearing arrangements required to meet specific conditions of accuracy and load on high-speed grinders, engine lathes and other precision machine tools.

Since standards of accuracy which call for tolerances of 0.0002-in. or less must be carried out, not only in the bearings, but in the entire spindle assembly, suggestions for precision fitting and mounting are included. Copy free upon request.

SKILSAW PORTABLE ELECTRIC TOOL CATALOG No. 36. The complete Skilsaw line of 66 electrically driven tools for maintenance and production operations on all kinds of manufacturing and construction work, including five new models of Skilsaw Electric Drills, are fully described and illustrated in this catalog which is now being issued by Skilsaw, Inc., 3316 Elston Avenue, Chicago, Ill. Included in the line of tools described in this catalog are electric hand saws, portable belt sanders, drills, ball bearing blowers and suction cleaners, ball bearing electric hand grinders, bench and pedestal grinders and buffers. Included, also, are various accessories and tools such as emery wheels, hole saws, rotary files, chucks and sleeves, and other tools.

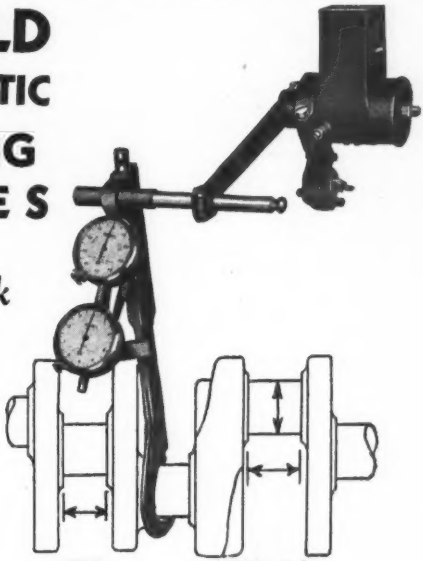
Copy free upon request.

ERRATUM

In the announcement of the Federal Model 95 Clear Vision Indicator which appeared on Page 110 of the November 1935 issue of this magazine, the statement was made that a division of 1/10,000 in. is approximately 1/10 of an inch wide on the dial. This statement is in error; actually a division of 1/10,000 in. measures 1/5 of an inch on the dial.

ARNOLD AUTOMATIC GRINDING GAUGES

For Faster Work Greater Accuracy



Tells the exact size while grinding. Operator can crowd the machine to its utmost without fear of grinding undersize. Greater accuracy with no waste—greater production.

Write for Bulletin B describing different types.

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If you are interested in prices or information on any of the equipment listed, check the ite write your name, firm name, title and address on the margin, tear out the page and send it t Modern Machine Shop, 704 Race Street, Cincinnati, Ohio. We will see that you are suppli with the information desired.

- ☐ Abrasive Discs
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- ☐ Bolt and Nut Machinery
- ☐ Bolts and Nuts
- ☐ Bolts, Stripper
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- ☐ Boring Heads
- ☐ Boring Tools
- ☐ Broaches
- ☐ Broaching Machines
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- ☐ Drilling Mach., Heavy Duty
- ☐ Drilling Machines, Multiple
- ☐ Drilling Machines, Radial
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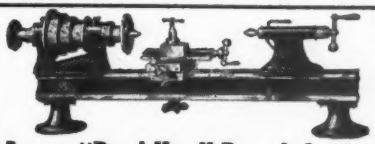
- ☐ Gauges, Thread
- ☐ Gear Blanks, Composition
- ☐ Gear-Cutting Machinery
- ☐ Gears, Cast or Cut
- ☐ Grinding Mach., Cylindrical
- ☐ Grinding Machines, Univ.
- ☐ Grinding Machines, Cutter
- ☐ Grinding Machines, Drill
- ☐ Grinding Machines, Internal
- ☐ Grinding Machines, Portable
- ☐ Grinding Machines, Surface
- ☐ Grinding Wheels
- ☐ Grinding Wheel Stands
- ☐ Hammers, Pneumatic
- ☐ Hobbing Machines
- ☐ Hobs, Gear
- ☐ Hoists, Chain or Electric
- ☐ Indicators, Speed or Test
- ☐ Jacks, Planer
- ☐ Keyseating Machinery
- ☐ Lapping Machines
- ☐ Lathes, Engine
- ☐ Lathes, Turret
- ☐ Lathes, Automatic
- ☐ Lathes, Bench
- ☐ Lathes, Gap
- ☐ Lathes, Polishing
- ☐ Lathe Dogs
- ☐ Lubricants
- ☐ Mandrels, Expanding
- ☐ Mandrels, Solid
- ☐ Micrometers
- ☐ Milling Machines, Automatic
- ☐ Milling Machines, Bench
- ☐ Milling Machines, Horizontal
- ☐ Milling Machines, Vertical
- ☐ Milling Attachments
- ☐ Milling Tools
- ☐ Oil-Grooving Machines
- ☐ Oil Stones
- ☐ Oils
- ☐ Ovens, Industrial
- ☐ Parallels
- ☐ Pipe-Cut'g & Thr'd'g Mach
- ☐ Pipe Tools
- ☐ Planers
- ☐ Polishing & Buffing Machs.
- ☐ Presses, Arbor
- ☐ Presses, Punch
- ☐ Pulleys, Metal or Wood
- ☐ Pumps, Lubricants or Oil
- ☐ Punches, Hand
- ☐ Punches, Power
- ☐ Punch Holders
- ☐ Racks, Cut
- ☐ Reamer Holders
- ☐ Reamers, Adjustable
- ☐ Reamers, Solid
- ☐ Riveting Machines
- ☐ Rules, Steel and Wood
- ☐ Rust Preventatives
- ☐ Saws, Metal
- ☐ Saw Frames and Blades
- ☐ Sawing Machines, Power
- ☐ Saws, Band
- ☐ Saws, Milling
- ☐ Scales, Machinists'
- ☐ Screw Machines, Automatic
- ☐ Screw Machines, Hand
- ☐ Screws, Cap, Set or Mach.
- ☐ Screws, Hardened Drive
- ☐ Screws, Self-Tapping
- ☐ Shafting
- ☐ Shafts, Flexible
- ☐ Shapers
- ☐ Shears, Hand or Power
- ☐ Sleeves, Drill
- ☐ Springs, Pressure Pad
- ☐ Squares
- ☐ Stamps, Steel
- ☐ Stands, Shop, Portable
- ☐ Tap Holders
- ☐ Tapes, Measuring
- ☐ Tapping Machines
- ☐ Tapping Attachments
- ☐ Taps and Dies
- ☐ Taps, Collapsible
- ☐ Testing Mach'y, Hardness
- ☐ Thread-Cutting Tools
- ☐ Threading Machines
- ☐ Thread Mill. & Roll. Mach'y
- ☐ Tool Bits
- ☐ Tool Cases
- ☐ Tool Holders
- ☐ Tool Posts, Lathe
- ☐ Trolleys and Tramways
- ☐ Trucks, Hand, Lift, Power
- ☐ Turrets, Tool Post
- ☐ Valves, Air Control
- ☐ Vises, Bench or Machine
- ☐ Welding Equip. & Supplies
- ☐ Welding Machines, Electric
- ☐ Wrenches, Drop-Forged
- ☐ Wrenches, Pipe
- ☐ Wrenches, Ratchet
- ☐ Wrenches, Tap

MADISON BORING CUTTERS AND BARS. The adjustable boring cutters made by the Madison Manufacturing Company, Muskegon, Mich., are described and illustrated in this booklet. Included among the tools shown here are Madison adjustable boring cutters and bars for use in automatic or turret lathes, adjustable boring cutters for all kinds of machine work, taper reamers in which Madison adjustable cutters are used, multiple cutters, bottoming tools, and so on. The book also describes and illustrates the grinding bar that is used in grinding these cutters and shows a wide variety of the work upon which these cutters are being successfully used.

A copy of this booklet will be sent to any mechanical executive or buyer of tools upon request.

SCULLY-JONES TOOLS. Scully - Jones & Co., 1907 S. Rockwell St., Chicago, Ill., are now distributing a new 8½x11-in. catalog containing 144 pages of detailed engineering information covering the complete line of production tools for drilling, tapping, reaming and counterboring made by this firm.

A copy of the catalog is available to any mechanical executive upon request.



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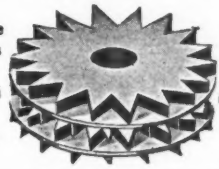

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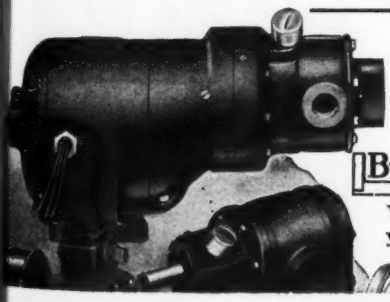

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KELLER BURRS AND ROTARY FIL are illustrated and described in a n 12-page book which has been issued the Pratt & Whitney Company, Kel Division, Hartford, Connecticut. A co of this book will be sent to mechanic executives upon request.

SMALL-LOT STAMPING PRODU TION. The speed, accuracy, and oth advantages that are now available wi small-lot production of stampings a discussed in a folder that has been i sued by Dayton Rogers Manufacturi Co., 1114 S. Third St., Minneapol Minn. Copies free upon request.

Lathe Builders Make An Announcement

Pursuant to publication in the Oct ber, 1935, number of MODERN MACHIN SHOP of a statement that a certai brand of lathe is now available wi the "American Standard" Spindle No the secretary of the Lathe Group of t N.M.T.B.A. has requested that an a nouncement be made to the effect th although the lathe builders are no working on a standard which may b adopted at their next meeting, no stand ard spindle nose has been adopted yet.

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